Electrical World

MAY 4, 1940

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Electrical World
Table I—Data on Output and Peak Load of Largest Generating and Distributing Systems in North America, 1939-1938

28th ANNUAL SURVEY OF 100,000,000-KW.-HR. SYSTEMS

3 Cost-Cutting INSTRUMENTS

for the cost-saving maintenance program

By eliminating many of the time-consuming steps in electrical test procedure . . . by providing the useful scope of several or more instruments in one compact unit . . . these three WESTON Maintenance Tools bring new cost-saving opportunities to electrical maintenance. In addition, they're WESTON built . . . assuring the ruggedness and dependable accuracy so essential for active maintenance requirements.

Be sure to send for complete information on these and other WESTON maintenance instruments . . . as well as on WESTON multi-range, multi-purpose instruments for all production and inspection needs. Weston Electrical Instrument Corporation, 578 Frelinghuysen Avenue, Newark, New Jersey.

WESTON *Instruments*

1

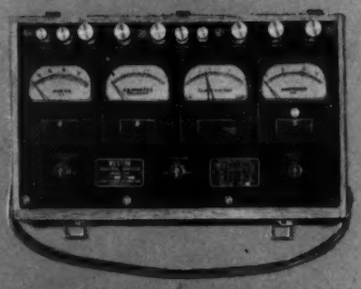
The WESTON AC Clamp-Ammeter

A real time saver. Simply hook the jaws around the conductor while machinery is running, and take the current reading. No production interruptions as circuits are never disturbed. Rugged construction, with high insulation. Six current ranges answer all maintenance needs.

2

WESTON Model 785 Industrial Circuit Tester

Provides new convenience in testing signal, control and electronic circuits. Has 27 voltage current and resistance ranges. High sensitivity for testing photo-cell and oscilloscope circuits, and other plant maintenance and production requirements.



3

WESTON Industrial Analyzer

Another time saver for the active maintenance department. With all interconnections made, only one hook-up is necessary for complete analyses. Measures current, voltage and power in single and polyphase circuits, as well as power factor in 3 phase, 3 wire circuits. Furnished in sturdy oak carrying case.

Tell the Owners

How can we expect the American public to understand what utilities mean to employment, business, comfort and better living when the owners of the business don't know and haven't been told? The number of electric utility stockholders probably runs into millions, few of whom know enough about the business to defend it properly and many of whom probably have some doubts about it.

At his first annual meeting, E. L. Shea, six months president of North American, said:

> I will say to you frankly that prior to my association with the utility industry I did not have an adequate picture of the real service performed by companies like North American. However, after studying the situation since my connection with the company, I have come to the conclusion that the American public, and to some extent even investors in public utilities stocks, are not fully conscious of the service rendered by companies like North American, and do not better understand the great economic justification for their existence.

In creating an improved public understanding the utilities must first enlist the help of their wage earners—those who get the wages of work, employees, and those who get the wages of money, stockholders. They must be educated in what the utilities do to create economic and social opportunities.

We have had a sort of employee and stockholder education in the industry, but it has been too much on the defensive side.

The story of constantly lowered rates is all right, but how much does it mean to the average man on the street, especially when government takes the credit? Nor is the public much aroused over the mounting tax burden of utilities. Somebody has to pay the cost of government.

What the public wants to know is why it should support privately owned utilities. What benefits does it derive? In other words, the educational work of the utilities must be aggressive, positive, constructive.

ELECTRICAL WORLD has for a long time been trying to indicate approaches to a better understanding. First in its Public Relations charts, in the fall of 1938; again last June, when it stimulated employees to search for the romance in the industry, and next month, when through the invention of Dinner-Pail Dollars it will show how the utility construction expenditures percolate into every corner of the American economy. Other inserts of an educational nature will appear from time to time.

But this is not enough. Some central agency should be preparing in simple form basic information to tell people, and especially employees and stockholders, how utilities benefit people and business, how they create employment and better wages, how they help to keep down costs and improve quality for industry, how they make living safe—and why a profit is not a crime, but a public blessing.

The utilities have been terror stricken, afraid to make a move lest it be misinterpreted and bring down more wrath upon their heads. Nor have they been alone. Business generally has been frightened until recently, when it began to take its story aggressively to the people.

This is the time to take the offensive. The utilities have contributed to American social and economic progress. It is no accident that the nation with the highest wage rate and the greatest productive capacity is also the nation with the most extensive electric utility service. Let's tell about it.

Utilities Make Greater Use of Available Capacity

"Electrical World's" 28th annual survey of 100,000,000-kw.-hr. systems includes operating data for 184 light and power companies in North America — Reveals increased utilization, plant and load factors

CHARLES DE VORE, Assistant Editor

THANKS to the co-operation of utility executives—and to the output record set last year—this year's survey of major generating and distributing systems includes performance statistics for 184 companies—more than any previous survey. In the supplement to this issue Table I gives output and peak load data for 1936 to 1939. Detailed information on generator rating, output, consumers and distribution of energy for 1939 will be found in Table II, which also carries a summary of generator rating and output.

HIGHER utilization factors, plant factors and load factors are disclosed by ELECTRICAL WORLD's 28th annual survey of 100,000,000-kw.-hr. systems. Of the 150 companies in the United States, covering 92 per cent of the installed capacity of the industry, 131 reported information from which utilization factor (ratio of generator peak to generator capacity) could be calculated. The chart of utilization factors shows that the median in 1939 was about 75 per cent; in 1938 it was nearer 70.

In 1939, 53 companies, with a capacity of 10,401,591 kw., or 35 per cent of the total in Table III, had utilization factors of 80 per cent or higher; in 1938 the corresponding figures were 31 companies and 16 per cent of the total capacity. Seventeen of these companies overshot the hundred per cent mark; there were sixteen such companies in 1938 and ten in 1937. Twenty-one companies, with 8 per cent of the total capacity, were below 60 per cent in utilization factor, leaving 57 companies, accounting for approximately 57 per cent of the total capacity, in the range from 60 to 80 per cent. Utilization factors for the individual companies, incidentally, varied from 22.2 to 123.2 per cent.

To aid further analysis of this point, changes in regional utilization factors during 1938 and 1939 are shown in Table IV. For the above 131 companies generator capacity increased about 4 per cent in 1939 over 1938, while generator peaks were about 13 per cent higher. The average national utilization factor rose some 9 per cent. Regional utilization factors ranged from 62.9 to 75.0 per cent in 1938, with an average of 69.3 per cent; in 1939 the range was from 65.8 to 84.1 per cent, with an average utilization factor of 75.5 per cent.

On the basis of these data, it might be argued that reserve capacity of the electric light and power industry in the United States was only 25 per cent last year, while in 1938 it was 30 per cent. Such an assumption, like so many generalizations, is somewhat erroneous. These aggregate peaks were not coincident. Peak diversity permits large interchanges of energy through interconnection as

Table III—Generator Capacities Grouped by Utilization Factors

Utilization Factor, Per Cent	Number of Systems	Generator Capacity, Kw.
100 and more	17	1,473,499
90 to 99.9	11	628,199
85 to 89.9	8	1,651,195
80 to 84.9	17	6,648,698
75 to 79.9	11	5,544,001
70 to 74.9	20	4,257,019
65 to 69.9	15	5,676,507
60 to 64.9	11	1,141,480
50 to 60	13	1,770,822
Less than 50	8	720,655
	131	29,512,075

Table IV—Comparison of Generator Capacity and Aggregate Generator Peaks, by Regions

Region	1939			1938		
	Capacity Reported, Kw.	Aggregate Peaks, Kw.	Ratio, %	Capacity Reported, Kw.	Aggregate Peaks, Kw.	Ratio, %
New England	2,239,025	1,632,284	73.0	2,325,302	1,551,097	66.7
Middle Atlantic	9,229,111	6,942,447	74.6	9,366,974	6,368,850	68.2
E. North Central	6,717,474	5,104,373	76.0	6,478,805	4,627,429	71.3
W. North Central	2,414,736	1,589,718	65.8	2,331,608	1,467,739	62.9
South Atlantic	1,618,253	1,360,128	84.1	1,590,025	1,176,464	73.9
E. South Central	1,763,963	1,332,390	75.5	1,703,590	1,117,168	65.5
W. South Central	1,669,590	1,265,511	75.7	1,430,622	1,073,180	75.0
Mountain	1,574,869	1,255,560	79.6	955,524	672,985	70.5
Pacific	2,285,054	1,757,290	76.7	2,228,839	1,634,405	73.3
United States	29,512,075	22,239,701	75.5	28,411,289	19,689,317	69.3

shown on Table II. The available reservoir of capacity reserve therefore is substantially in excess of the 25 per cent.

The average utilization factor of 75 per cent does, however, serve as an over-all indication of national conditions as substantiated by these facts: Output last year was about 13 per cent ahead of 1938; drought affected the availability of hydro capacity last year; this year, for the first time in a decade, proposed capacity additions, as reported to ELECTRICAL WORLD, are in excess of 2,000,000 kw. (EW, January 13, 1940, page 76).

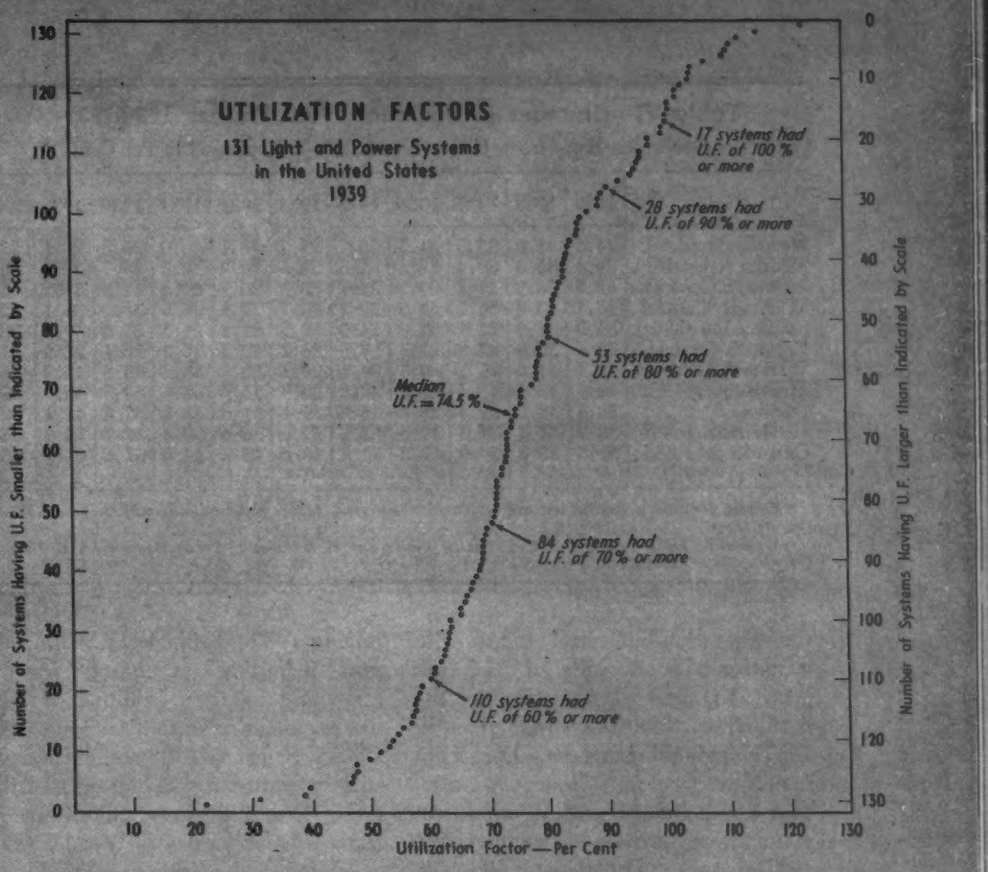
Load Factor Improved

Another guide to station performance is load factor [kw.-hr. ÷ (peak kw. × 8,760)]. The trend for thirty top systems whose output in 1939 was 65 per cent of the total in this survey is shown by Table V; while corporate changes and other elements affect the annual totals, the changes in "combined load factors" are probably typical. An increase for 1939 over 1938 of about 14 per cent in system output, including purchased energy, with a rise of about 12 per cent in aggregate system peaks, brought about an improvement in group load factor from 53.7 per cent in 1938 to 54.5 per cent in 1939.

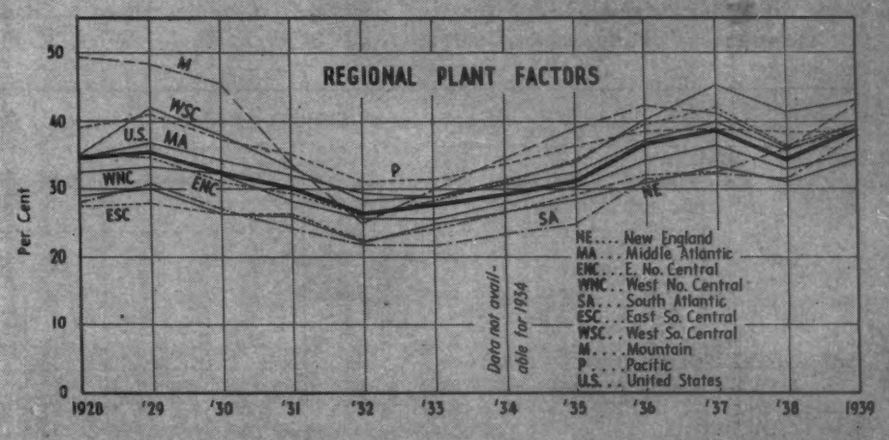
Plant factor [kw.-hr. generated ÷ (plant kw. × 8,760)] gives another measure of the use of available capacity. Regional changes over a period of years are recorded in Table VI. In 1939 plant factors ranged from 34.6 per cent for New England to 43.1 per cent for the West South Central region, with an average for the United States of 38.7 per cent. A year ago these factors varied from 31.0 for New England to 41.0 for

Table V — Output, Aggregate Peaks and Group Load Factors, 30 Systems—1931-1939

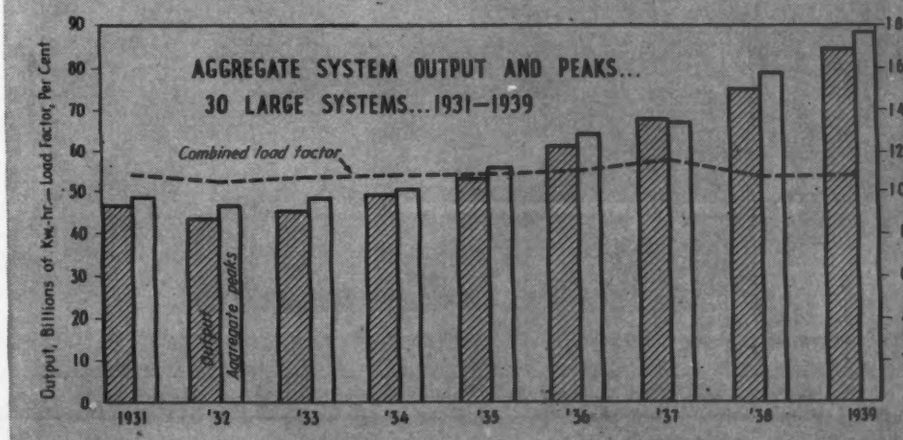
Year	System Output Millions of Kw.Hr.	Aggregate Peaks, Thousands of Kw.	Combined Load Factor, Per Cent
1931	46,989	9,870	54.3
1932	43,036	9,378	52.3
1933	45,435	9,714	53.3
1934	48,785	10,181	54.7
1935	53,019	11,120	54.3
1936	61,371	12,788	54.8
1937	67,089	13,256	57.8
1938	74,596	15,842	53.7
1939	84,875	17,775	54.5


UTILIZATION FACTORS
131 Light and Power Systems in the United States 1939
17 systems had U.F. of 100 % or more
28 systems had U.F. of 90 % or more
53 systems had U.F. of 80 % or more
Median U.F. = 74.5 %
84 systems had U.F. of 70 % or more
110 systems had U.F. of 60 % or more
Number of Systems Having U.F. Smaller than Indicated by Scale
Number of Systems Having U.F. Larger than Indicated by Scale
Utilization Factor — Per Cent

UTILIZATION FACTOR was under 80 per cent in 1939 for 78 of these 131 companies, which accounted for 65 per cent of the capacity



REGIONAL PLANT FACTORS were higher than in 1938, but United States average was lower than in 1937


AGGREGATE SYSTEM OUTPUT AND PEAKS...
30 LARGE SYSTEMS...1931—1939
Combined load factor
Output, Billions of Kw.-hr.—Load Factor, Per Cent
Aggregate Peaks, Millions of Kw.
Output
Aggregate peaks
1931 '32 '33 '34 '35 '36 '37 '38 1939

TOTAL SYSTEM OUTPUT of thirty top companies showed 14 per cent rise in 1939 over 1938; aggregate system peaks increased 12 per cent and load factor 2 per cent

Table VI—Changes in Regional Plant Factors 1928-1939 *

Generated Kw.-Hr. ÷ (Plant Kw. × 8,760) Expressed in Per Cent

Region	1939	1938	1937	1936	1935	1933	1932	1931	1930	1929	1928
New England.....	34.6	31.0	33.6	31.2	28.7	24.7	22.4	26.0	26.3	30.1	29.2
Middle Atlantic...	39.4	35.5	39.9	37.2	32.6	29.3	29.4	32.3	34.7	37.3	35.0
E. North Central..	39.2	35.9	41.8	39.7	34.7	28.0	26.1	29.6	31.5	35.1	35.3
W. North Central.	35.4	33.0	36.7	34.5	30.2	25.7	25.9	28.6	32.7	34.1	32.8
South Atlantic (a).	37.9	31.6	32.9	32.0	24.9	22.2	22.4	24.6	27.0	30.9	28.1
E. South Central..	38.4	36.0	33.8	32.5	28.8	24.2	22.5	26.3	26.1	27.6	27.1
W. South Central.	43.1	41.0	45.2	40.3	34.1	29.1	28.6	33.2	38.6	41.9	35.2
Mountain.....	42.3	35.9	41.4	42.2	38.8	29.9	24.9	34.1	45.5	48.6	49.6
Pacific.....	38.4	38.2	39.3	38.5	36.0	31.1	31.0	35.5	37.8	41.1	39.2
United States (a)	**38.7**	**34.5**	**39.1**	**37.0**	**32.5**	**27.6**	**26.6**	**30.3**	**32.7**	**35.9**	**34.3**
Canada (a).....	**60.3**	**55.8**	**59.0**	**57.2**	**53.2**	**43.4**	**42.7**	**44.4**	**51.1**	**61.7**	**55.2**

* Column for 1934 is omitted because data from which plant factors could be computed were not collected for that year.

(a) Omitting Duke Power, Canadian Niagara Power and Hydro-Electric Power Commission of Ontario, for which detailed data are not available.

the West South Central states, with a nation-wide average of 34.5 per cent. In spite of the increase, the national average was lower than in 1937; regional plant factors, except for New England, South Atlantic, East South Central and Mountain regions, were also under comparative 1937 figures. The rise to 60.3 per cent for Canada made this plant factor the largest since 1929, when it was 61.7.

No radical change is apparent in the summary of allocation of output during 1939 (Table VII). Total output, including purchased energy, amounted to 131.6 billions of kw.-hr., a gain of about 13 per cent over 1938. Sales to ultimate consumers still accounted for 71 per cent of the total, breaking down about as in 1938. Among sales for resale, sales to other public utilities accounted for 14.6 per cent of the total, instead of 13.5 per cent as in 1938.

Since 1939 marks the end of a decade, it affords a chance for comparisons with the beginning of the ten-year period. In 1929 ELECTRICAL WORLD's annual survey listed 137 systems with a total generated output of 81,561,345,767 kw.-hr.—a 12 per cent increase over 1928. There were 26 systems in the billion kw.-hr. class. Ten years later 150 systems reported a generated production of 116,724,505,000 kw.-hr., approximately a 43 per cent increase in output by 9.5 per cent additional companies. There were 33 systems in 1939 that had a total output, including purchased energy, of more than a billion kw.-hr. Last year four companies had system peaks of more than a million kw., the highest being 1,660,000 kw. Ten years ago three companies had system peaks higher than a million kw., with the highest 1,209,000 kw. In 1919 the highest system peak was 428,630 kw.

Generator capacity reported in the 1929 survey totaled 25,911,781 kw. for 1,740 plants. In 1939 the total was 34,382,006 kw. for 1,796 plants, or a gain of about 33 per cent in capacity with an increase of only 3 per cent in number of plants. Table VI shows that plant factor for the United States had increased to 38.7 per cent in 1939 from 35.9 per cent in 1929.

Table VII—Allocation of Output of Major Light and Power Systems, 1929 to 1939*

Class of Service	150 Systems in 1939			145 Systems in 1938			146 Systems in 1937			148 Systems in 1936			144 Systems in 1932			137 Systems in 1929		
	Millions of Kw.-Hr.	Per Cent of Total	Per Cent of Sales	Millions of Kw.-Hr.	Per Cent of Total	Per Cent of Sales	Millions of Kw.-Hr.	Per Cent of Total	Per Cent of Sales	Millions of Kw.-Hr.	Per Cent of Total	Per Cent of Sales	Millions of Kw.-Hr.	Per Cent of Total	Per Cent of Sales	Millions of Kw.-Hr.	Per Cent of Total	Per Cent of Sales
Farm or rural..	2,122	1.6	2.3	1,983	1.7	2.4	1,824	1.5	2.1	1,574	1.4	2.0	9,814	11.3	17.0	7,561	8.0	11.3
Domestic.....	17,088	13.0	18.2	15,681	13.4	18.8	14,405	11.8	16.4	12,879	11.2	16.0						
Com'l retail....	17,778	13.5	18.8	14,618	12.5	17.5	13,864	11.3	15.8	12,430	10.8	15.3	9,089	10.4	15.7	9,184	9.7	13.7
Com'l wholesale	47,088	35.7	50.2	41,943	35.9	50.3	48,819	40.0	55.5	44,307	38.6	54.9	29,993	34.6	51.8	41,752	44.1	62.5
Municipal.....	2,122	1.6	2.3	2,023	1.7	2.4	2,095	1.7	2.4	2,929	2.6	3.6	2,512	2.9	4.3	2,230	2.4	3.3
Other sales	1,795	1.4	1.9	1,669	1.4	2.0	1,227	1.0	1.4	721	0.6	0.9	1,231	1.4	2.1	971	1.0	1.5
Railways and railroads.....	5,872	4.6	6.3	5,491	4.7	6.6	5,684	4.7	6.4	5,912	5.2	7.3	5,234	6.0	9.1	5,149	5.4	7.7
Used by ult. consumers.	93,865	71.4	100.0	83,408	71.3	100.0	87,918	72.0	100.0	80,752	70.4	100.0	57,873	66.6	100.0	66,847	76.6	100.0
Other public utilities.....	19,251	14.6	.....	15,840	13.5	.....	16,606	13.6	.....	17,756	15.5	.....	15,690	18.0	.....	13,290	14.0	.....
Affil. railway depts.‡.....	409	0.3	.....	555	0.5	.....	574	0.5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Used by companies.....	1,426	1.1	.....	1,387	1.2	.....	1,275	1.0	.....	1,177	1.0	.....	953	1.1	.....	1,395	1.5	.....
Losses, etc.....	16,619	12.6	.....	15,843	13.5	.....	15,792	12.9	.....	15,063	13.1	.....	12,397	14.3	.....	13,199	13.9	.....
Total gen. & purch.†....	131,570	100.0	.....	117,033	100.0	.....	122,165	100.0	.....	114,748	100.0	.....	86,913	100.0	.....	94,731	100.0	.....
Company use plus losses in per cent of generated†...	.....	15.8	.....	.....	16.6	.....	.....	15.7	.....	.....	16.5	.....	.....	18.7	.....	.....	17.9	.....

* For omitted years see ELECTRICAL WORLD May 5, 1934. † Excluding company that did not report allocation. ‡ Included in railways and railroads prior to 1937.

Portable Kit Dramatizes Poor Wiring

Designed for layman, kit employs coils of wire for resistance and produces effects on prospect's own wiring installation by introducing added loads and added resistance

WALTER C. HESTON,* Pacific Coast Electrical Bureau, Northern Division, San Francisco

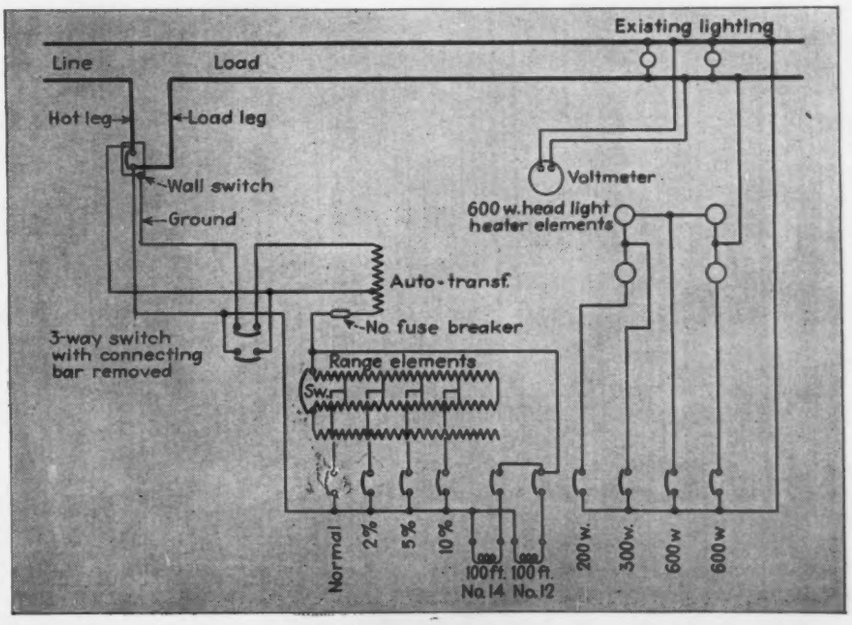
SEVERAL DEVICES have been made for demonstrating adequate wiring. But all of these of which the writer has knowledge simulate the customer's circuit conditions and rely on his imagination to transfer the example to his own premises. The kit which the writer has designed uses the existing lighting installation as a demonstration.

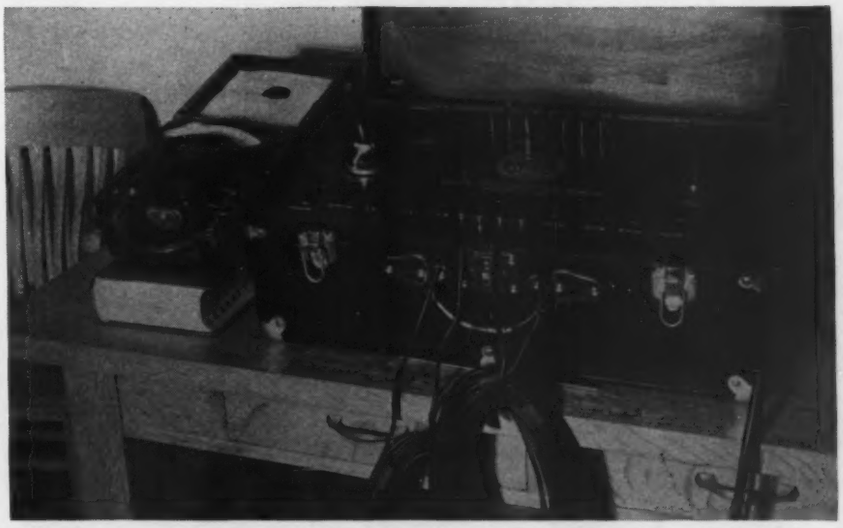
In office buildings voltage drops of 5 per cent are not uncommon, and where these exist an effective demonstration can be made with the kit, which is portable and includes an auto-transformer for boosting voltage to normal lamp-voltage rating. How the kit works is shown in the diagram. It is essentially in two parts, electrically. The first is placed in series with the circuit (an installed wall toggle switch is a convenient place to do this) and provides a means of controlling voltage at that point and of introducing various resistances to correspond to voltage drops for circuit runs. The other part parallels the circuit at the point of load and provides a means of adding various loads and thus showing what will happen to voltage at various projected load increases.

Arrangement of the various parts is shown in the illustrations, toggle switches being employed to cut in the various resistances. A tapped auto-transformer is employed, wound with No. 10 wire, but there are several compact units on the market which would be satisfactory if less capacity were desired.

In addition, 100 ft. of No. 14 wire

[*Continued on page 118*]





KIT IS MADE UP of equipment assembled on a hinged plywood panel in a fibre suitcase. It weighs 40 lb. Below the panel is the transformer and space for wire and voltmeter. Connections are made to existing wiring—in series at the switch and in parallel at the load. Electrically, it is in two parts, but physically the equipment is together in the kit

*Engineering consultant.

Increase Bus Capacity at South Meadow

Copper channel bus for the latest generation additions provides adequate current-carrying capacity — Through-type double-unit insulators for supports

lethod of supporting roof slab in later flanged construction in progress

exible connection provided between original three-bar section and added copper channel section

SEVERAL POINTS of interest for the engineering department were associated with the Hartford Electric Light Company's recent enlargement of its 11-kv. generating plant main bus capacity at South Meadow in connection with the addition of new turbo units. As originally installed in 1921, both 11-kv. main buses had three 4-in. x ¼-in. bars per leg laid flat, with an expected rating of 2,500 amp. Tests showed that the bus would not carry this amount of current without exceeding the specified temperature rise.

Early Additions

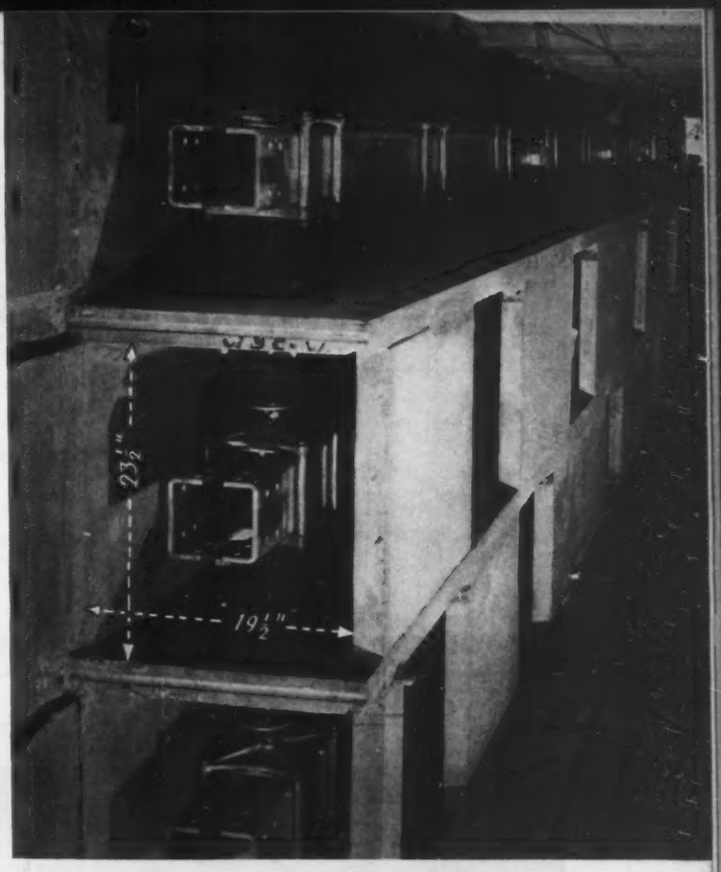
In 1929–30, when adding a 50,000-kva. generator to the station, a fourth bar was added to each leg, except for a short length of bus at the permanent (north) end, which remained three-bar. Heat runs on the four-bar section definitely proved that it would carry 2,700 amp. without excessive heating.

In January, 1938, when adding another 50,000-kva. generator, the four-bar length of each bus was removed and replaced by two 4-in., 8.58-lb. copper channels with flanges turned "in" to form a hollow square. These channels were mounted on new heavy-duty insulators supported on special bronze brackets designed to utilize as far as possible the existing inserts in the concrete bus structure. On the top leg of each bus it was necessary to drill one additional hole in the "front" bus wall for each new insulator bracket. To speed up this work the 2.5-in. vertical slabs which form the "back" wall of the bus structure were removed by carefully sawing out the joints with a hacksaw blade.

The roof slab meanwhile was supported by wooden sticks. These copper channels have a current-carrying capacity of 4,000 amp. and are the largest that can be installed in this bus structure, whose clear dimensions are 16 in. horizontal x 19.5 in. vertical, and maintain the necessary electrical clearance. In making the flexible connection between the copper channels and the original three-bar section Everdur bolts were used in assembling the joint.

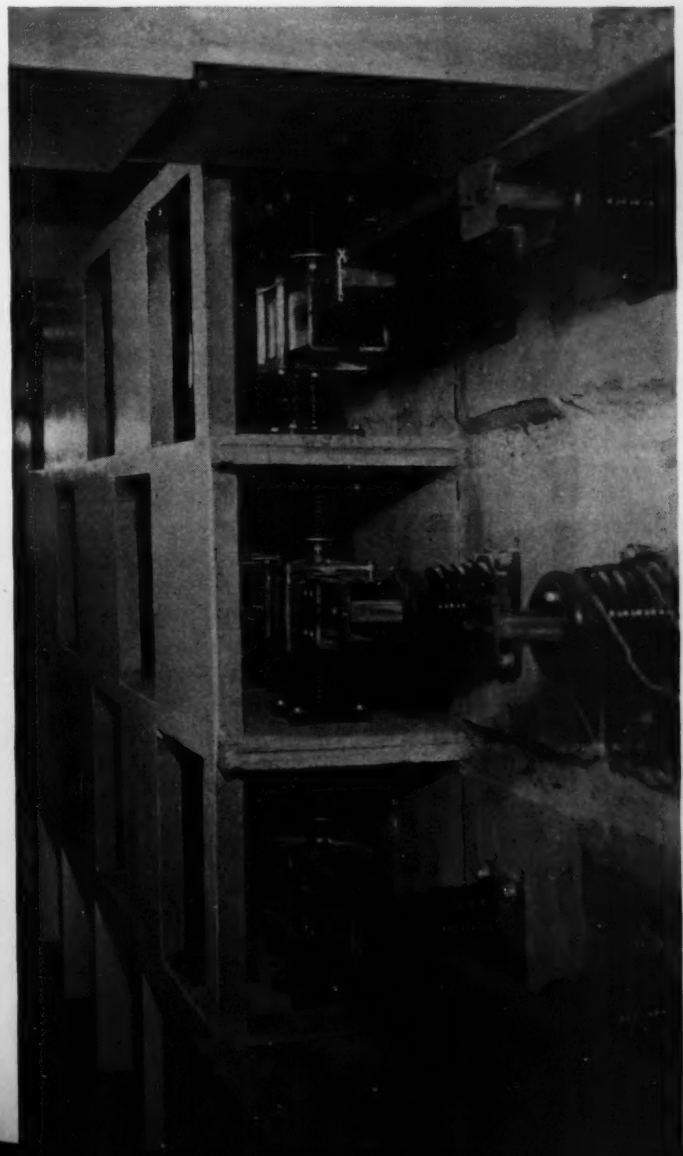
Each bus is divided into four sections, each being anchored near its mid-point and being free to expand either way.

The 1937 extension to both buses by the Stone & Webster Engineering Corporation is composed of two 6-in., 15.35-lb. copper channels mounted on double-unit "through"-type insulators. Fig. 4 was taken before the upper insulator on the top leg and the roof slab for the bus structure had been installed. This part of the bus has a rating of 5,000 amp. These new bus compartments have dimensions, in the clear, of 19.5 in. width by 23.5 in. height. As this new bus extension does not line up vertically or horizontally with the old bus structure a transition section of two 4-in. x 8.58-lb. channels with flanges turned in (up and down) and supported by heavy-duty insulators on the "front" wall was necessary. The joint between the 4-in. and 6-in. channels was later made up with flexible connectors.

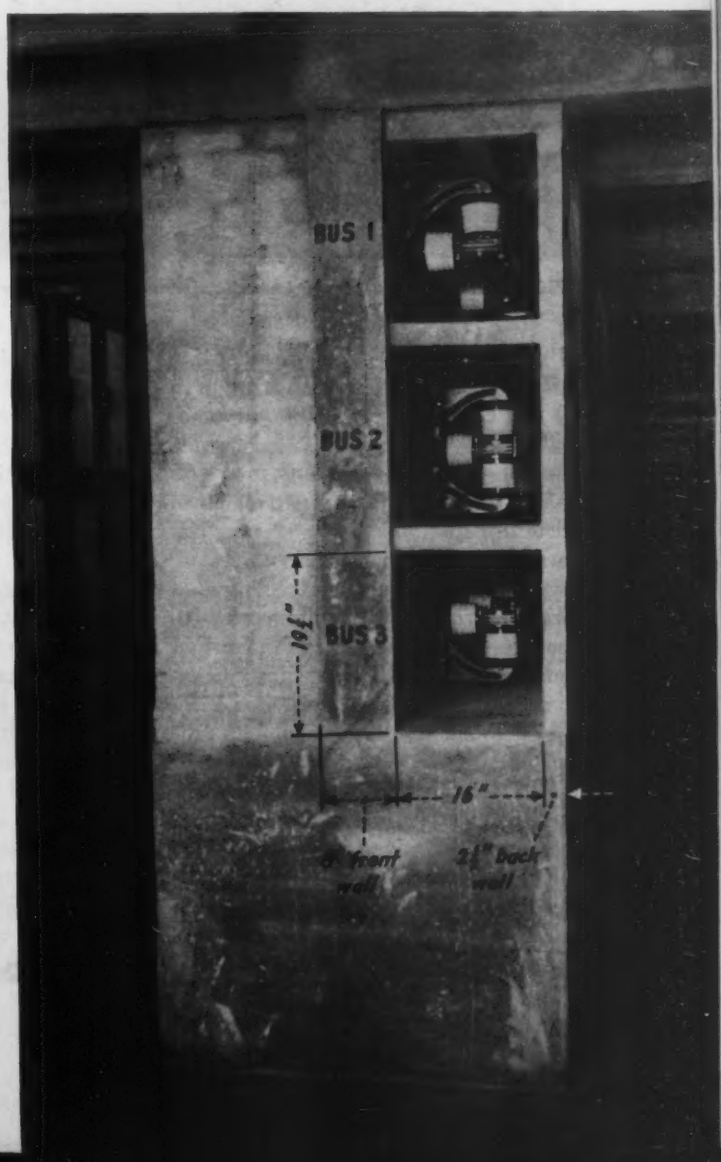


Copper channels mounted on double-unit insulators during latest construction

Transition section between old and new bus structures before flexible connectors were attached



Original bus construction had three flat bars per leg



Economic Study Determines Best Network Arrangement

Economic analysis determines best combination of primary voltage, number of primary feeders, secondary circuits and transformer units for small secondary network from standpoint of cost and operation

E. E. FORREST† and L. B. WICKERSHAM, JR.‡

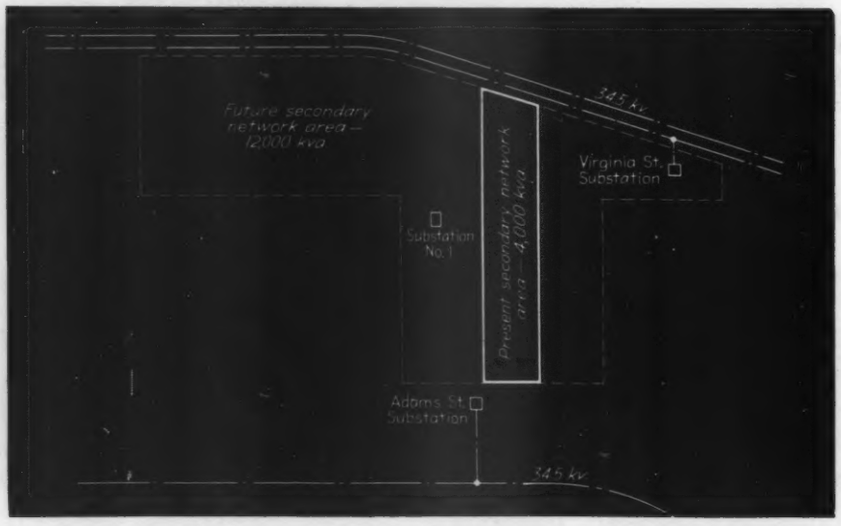


FIG. 1—Areas to be served immediately and ultimately by Gary secondary network

REHABILITATION of the distribution system of the Gary Heat, Light & Water Company, Gary, Ind., to facilitate a conversion from 25 to 60-cycle operation* presented many problems of an economic nature. Among them determination of the most practical arrangement of a secondary network system for the business section that would provide for enlargement to handle future load growth required consideration of a wide variety of alternate plans. This network area has a present load of 4,000 kva. and an estimated ultimate load of 12,000 kva.

In selecting the optimum network arrangement from the standpoint of cost and operation such variables as primary voltage, number of primary feeder circuits, number of parallel secondary circuits and number and size of transformer units had to be investigated both for the initial condition of 4,000 kva. capacity and for an assumed ultimate system of 12,000 kva. capacity.

As a result of the analysis outlined herewith it was decided to supply the network from two 5,000-kva., 34.5/13.8-kv. unit type substations tapping two existing 34.5-kv. transmission lines, with provision for a two-circuit outage and failure of either substation or transmission line without interruption of service. It was decided to extend two 13.8-kv. cables from each substation into the network area to supply the fifteen 500-kva. network transformers. Regulation by automatic tap changing under load was selected with equipment at unit substations adjusted to hold 13.8 kv. in each station and maintain 123/213 volts at the customers' entrance switch. When frequency conversion is completed the network system will be interconnected with a 4.33-kv. primary network serving the residential area through a 13.8/4.33-kv. transformation to permit utilization of excess capacity of the network unit substation on the 4.33-kv. network.

Consideration of Alternatives

To comply with all practical operating standards the alternatives to be considered were extended to include provisions for emergency conditions of operation and possible allowable limits of overload on transformers. All of the alternatives were worked out on the basis of a 3 per cent maximum allowable voltage drop in the secondary cable under normal conditions and without exceeding the normal current-carrying capacity of the cable under emergency conditions.

Voltage drop in a secondary network is dependent on two major factors, the number of transformer units and the number of parallel circuits, since each conductor is limited in size by its burnoff characteristics as established by the system in which it is to operate. Experience has shown that No. 4/0 or 250,000-circ.mil cable will clear faults with a much higher degree of reliability and much less smoke and explosive gases than can be expected when larger sizes are used.

* *Electric Light and Power*, March, 1939.

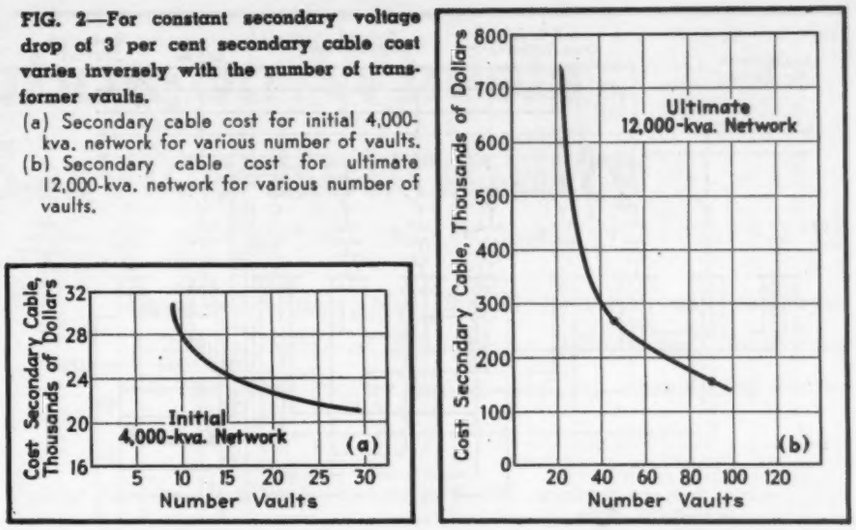
†Superintendent electrical division Gary Heat, Light & Water Company, Gary, Ind.

‡Formerly General Electric Company, Schenectady, N. Y. Mr. Wickersham is now with the Newport News Shipbuilding & Dry Dock Company, Newport News, Va.

With calculations based on a certain value of permissible voltage drop, the number of transformer units and secondary copper become functions of each other. Thus the curves of Fig. 2 (a and b) could be plotted showing the cost of secondary copper as a function of the number of transformer units for both the 4,000 kva. initial and 12,000 kva. ultimate systems respectively. Costs were based on 250,000-circ.mil non-metallic "Performite" cable, used throughout the secondary network study. Unit costs used in this analysis are tabulated in Table I. These costs include the installation expense.

FIG. 2—For constant secondary voltage drop of 3 per cent secondary cable cost varies inversely with the number of transformer vaults.

(a) Secondary cable cost for initial 4,000-kva. network for various number of vaults.
(b) Secondary cable cost for ultimate 12,000-kva. network for various number of vaults.



Number of Transformer Units

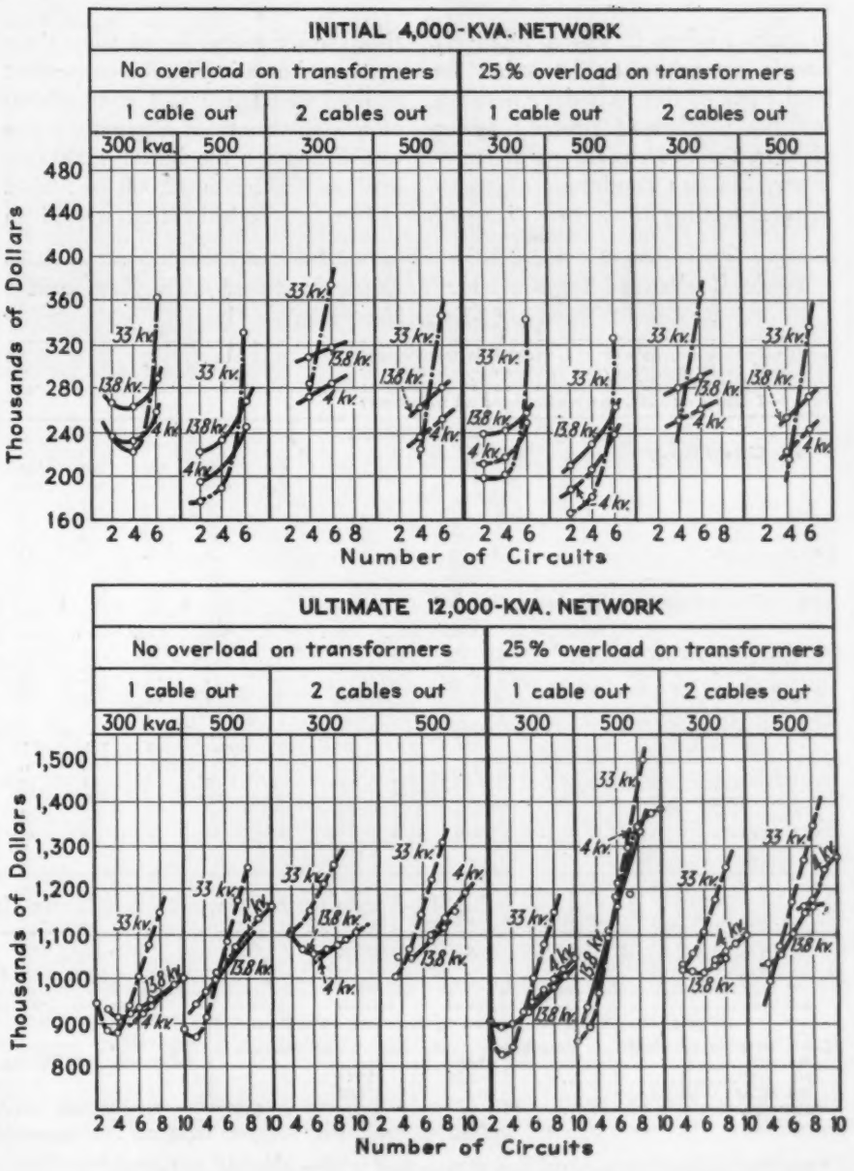
The number of transformer units is fixed by the number of primary feeders supplying the network. If, for example, in the 12,000-kva. network there are four primary feeders, 40 300-kva. transformer units will be required to handle the load under normal conditions. To make provision for continuous service under an emergency condition of a primary feeder outage 40 transformer units are required on the remaining three feeders to handle the load, thus requiring a total of 54 transformers on the four feeders. With provision for an emergency condition of a two-circuit outage (one circuit out of service for workmen and a second circuit trips due to fault) there must be 40 transformer units on the remaining two feeders and a total of 80 transformers would be required on the four feeders.

If overloads on transformers are permissible the number of transformer units required will be reduced and secondary copper must be increased accordingly to maintain voltage within allowable limits. A maximum emergency overload of 25 per cent on transformers was included as one of the conditions of this study.

The relationship between primary feeders and transformer units for the 4,000-kva. initial and 12,000-kva. ultimate network is shown in Table II for emergency conditions of one and two primary feeder outages, also transformer maximum operating conditions of 100 per cent load and 125 per cent load.

Having established the relationship between cost of copper and number of transformers and between number of transformers and the number of

FIG. 3—Comparison curves for initial and ultimate network show variation in total cost with network supply voltage, number of supply circuits, transformer size, permissible number of supply cables out of service and transformer loading.



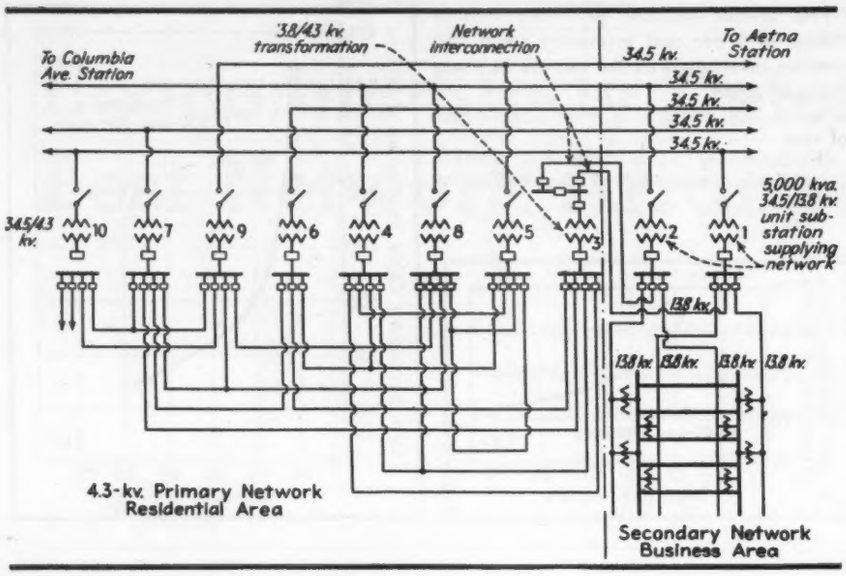


FIG. 4—Schematic diagram showing complete proposed distribution for Gary, Ind. Actual interconnection of secondary network and 4.3-kv. primary network awaits completion of frequency changeover.

primary feeders it was a relatively simple procedure to determine the total costs of the secondary network for any number of primary feeder circuits, the two conditions of emergency, the two conditions of transformer loading and two sizes of transformer units. By plotting these costs as shown in Fig. 3 a convenient method of making cost comparisons of a wide variety of alternatives was established for the initial 4,000-kva. load and ultimate 12,000-kva. load.

The first consideration was given to the sub-transmission voltage supplying the transformers. Inspection of the curves for both initial and ultimate load shows an advantage for 33 kv. The difference, however, was not considered sufficient to venture into the installation and maintenance of such high-voltage cable in view of the small quantity involved and the experience of present underground crews. The special training required and the uncertainty of the relative reliability of the 33-kv. cable eliminated this voltage from further consideration. The selection of 13.8 kv. as the supply voltage for the transformers was based on the greater cost of 4-kv. cable when the network is expanded to supply a 12,000-kva. load and the increasing differential in cost if the load should increase beyond this amount.

Transformer Overload

Next was the consideration of the section under "No Overload on Transformers" and the section under "25 per cent overload on Transformers." Fig. 3 shows a considerable added investment for a sufficient transformer capacity to operate without overloading, for all combinations of the 4,000-kva. network. However, it will be noted in the cost curves of the 12,000-kva. network that there is a very small differential between the costs for no overload and for 25 per cent overload, and that in some cases the cost is actually higher for permitting 25 per cent overload. This is due to the fact that in allowing a 25 per cent overload on transformers it is necessary to increase the amount of secondary copper to limit the voltage drop to 3 per cent. The cost of secondary copper, therefore, becomes a considerable factor in the over-all cost. The additional cost of transformer capacity when designed for no overload condition on the initial 4,000-kva. installation is, therefore,

[*Continued on page 120*]

Table II—Vaults Required for Various Cases of 4,000 Kva. and 12,000-Kva. Networks

Case 1—1 cable out, no overload allowed on transformer
Case 2—22 cables out, no overload allowed on transformer
Case 3—1 cable out, 25% overload allowed on transformer
Case 4—2 cables out, 25% overload allowed on transformer

4,000-Kva. Network

Case	Circuits Supply	2		4		6	
		300 Kva.	500 Kva.	300 Kva.	500 Kva.	300 Kva.	500 Kva.
1	No. Vaults	28	16	19	11	17	10
2	No. Vaults	....	....	28	16	22	12
3	No. Vaults	22	14	15	10	14	9
4	No. Vaults	....	....	23	15	17	11

12,000-Kva. Network

Case	Circuits Supply	2		3		4		5		6	
		300 Kva.	500 Kva.	300 Kva.	500 Kva.	300 Kva.	500 Kva.	300 Kva.	500 Kva.	300 Kva.	500 Kva.
1	No. Vaults	60	48	60	36	54	32	50	30	48	29
2	No. Vaults	....	....	....	....	80	48	68	40	60	36
3	No. Vaults	64	40	48	30	43	27	40	25	39	24
4	No. Vaults	....	....	....	....	64	40	54	34	48	30

Case	Circuits Supply	7		8		9		10	
		300 Kva.	500 Kva.	300 Kva.	500 Kva.	300 Kva.	500 Kva.	300 Kva.	500 Kva.
1	No. Vaults	47	28	46	28	45	27	45	27
2	No. Vaults	56	34	54	32	52	32	50	30
3	No. Vaults	38	24	37	23	36	23	36	23
4	No. Vaults	46	28	44	28	42	26	40	26

Table I—Secondary Network Unit Costs (Installed)

Item	33-Kv.	13.8-Kv.	4-Kv.
Network Vault			
300 kva.	$6,750.00	$5,460.00	$4,730.00
500 kva.	7,925.00	6,530.00	5,625.00
*Cable Installed per Foot			
No. 4/0	$4.42		
No. 1/0	3.34	$2.69	
350 MCM		3.40	
350/4 kv.			$3.05

Item	33-Kv.	13.8-Kv.	4-Kv.
Overhead Line Installed per Foot			
4-kv. No. 4/0			$0.95
13.8-kv. No. 1/0		$1.45	
33-kv. No. 1/0	$1.89		
Sw. position	$20,000.00		
Substations (2/5,000 kva.), each		$69,695.00 4 circuits	$61,740.00 4 circuits
Per additional circuit		$4,270.00	$4,170.00

Non-metallic "Performite" cable 250 MCM, 220 volts, per circuit foot—$2.87

* This item includes $1.30 per lineal foot of cable used to cover allocated duct costs.

Unit Substation on Wheels Has High Service Reliability

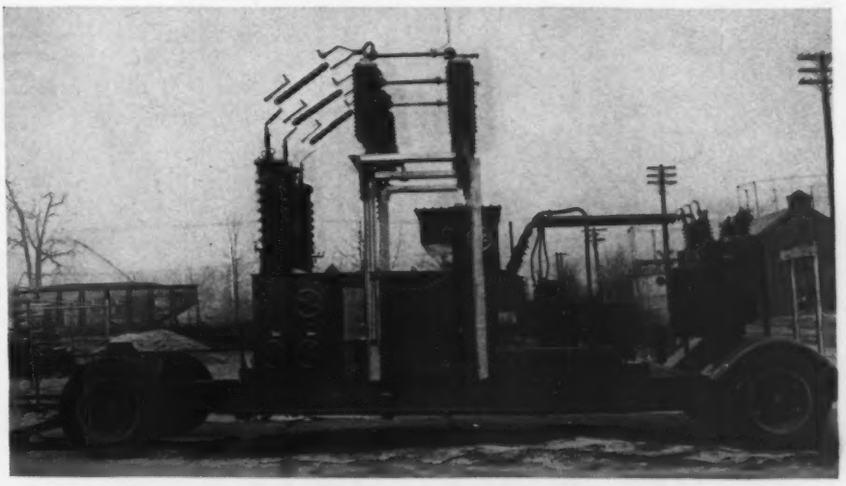
Illinois utility assembles flexible 1,500-kva. unit substation on mobile trailer at $13,000 cost — Horizontal transformer with forced oil cooling and no-load tap changing a feature

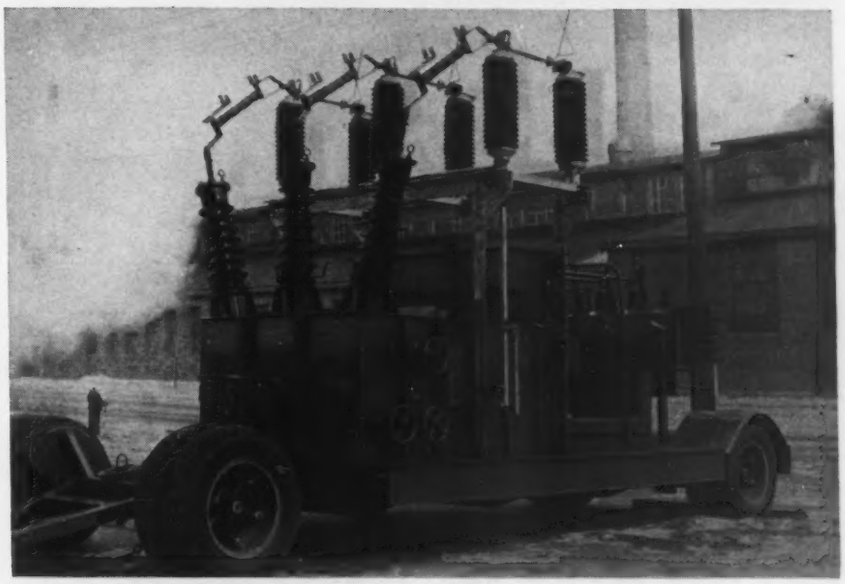
J. D. ROBERTS, Central Illinois Public Service Company, Springfield, Ill.*

AN APPROACH to the reliability of a stationary substation at reasonable cost and within the space and weight confines imposed by modern highways and highway laws was attempted in designing the 1,500-kva. mobile unit substation recently introduced on this system for emergency and maintenance service. The unit, requiring special transformer and trailer equipment, cost about $13,000, or $8.75 per kva., and weighs 15¾ tons.

Stand-out features of the new design are: (1) Its low over-all height; with arcing horns removed it will pass under a 12-ft. 6-in. subway or viaduct. (2) Its compact arrangement; the entire substation is mounted on an eight-wheel Jahn's trailer having an over-all width of 8 ft. and a center-to-center wheelbase of 19 ft. 1 in. (3) Its electrical flexibility, that permits the unit to meet a wide range of voltage conditions to be found on the system. (4) Provision of forced oil cooling and no-load tap changing on the main transformer.

Principal equipment on the substation trailer consists of Ohio Brass station post insulated Royal Electric & Manufacturing Company air-break switches and high-voltage S & C liquid fuses, through which primary power is supplied to a main transformer rated 1,500 kva. at 66,000/33,000 — 2,300/4,600/6,900/11,940 Y volts. Secondary power passes to an Automatic Switch Company circuit breaker of the 15,000-volt class which has sufficient interrupting capacity to handle the entire output of the substation. Auxiliary transformers with multiple series windings, mounted integral with the transformers' main base, furnish power to the main transformer oil circulating pump motors and to forced air-blast





SPECIAL HORIZONTAL 1,500-kva. transformer keeps down over-all height. Special forced cooling permits 33 1/3 per cent overloading

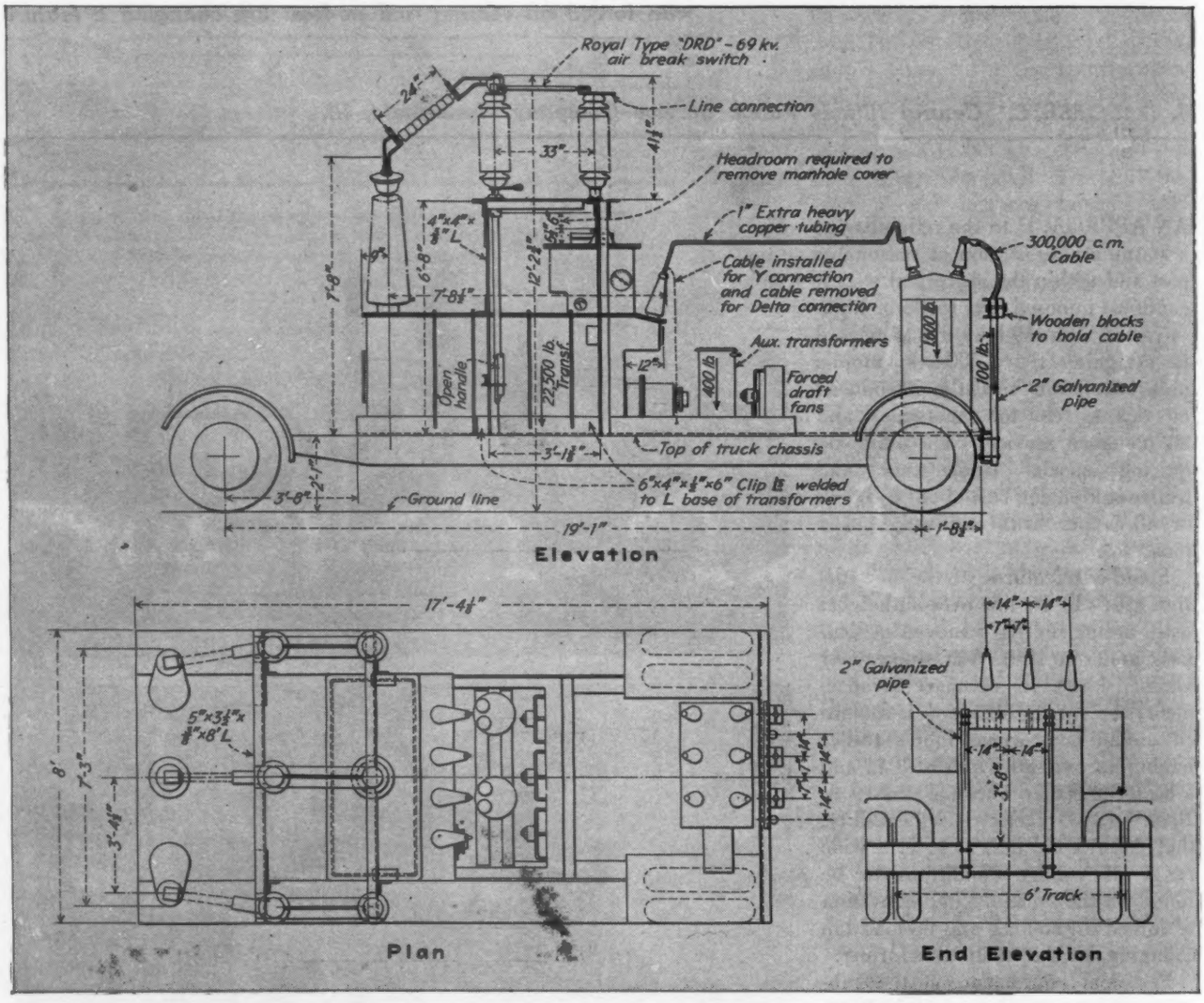
*Chief Engineer.

fans for the oil cooling radiators. They have sufficient capacity to supply power for illumination when the substation is in service.

The main transformer, a special Westinghouse design, has its major dimension horizontal rather than vertical, as is customary, in order to reduce over-all height. Though normal rating is 1,500 kva., a forced oil circulation and cooling arrangement permits the unit to carry 2,000 kva. above the main transformer allows the unit about one foot clearance in passing through the lowest subway the company knows of on the present Illinois highway system. As stated the unit will pass under any viaduct having a 12 ft. 6 in. clearance.

Integrating watt-hour meter and relays are housed in the large cabinet on the end of the oil circuit breaker, while the small cabinet on the opposite end of the oil breaker contains oil circuit breaker, is a small structure with a channel iron cross-member. Wood clamps mounted on this cross-member provide for attaching portable feeder cables to prevent any strain of these cables being transmitted to oil circuit breaker bushings.

Complete with trailer, which was made by C. R. Jahn Company, the portable substation weighs 31,500 lb. Wheel loading of about 4,000 lb. is well within the Illinois State High-


Royal Type "DRD" - 69 kv. air break switch
Line connection
Headroom required to remove manhole cover
1" Extra heavy copper tubing
300,000 c.m. Cable
Cable installed for Y connection and cable removed for Delta connection
Wooden blocks to hold cable
Aux. transformers
Forced draft fans
2" Galvanized pipe
Top of truck chassis
6"x4"x⅜"x6" Clip ∠ welded to L base of transformers
Ground line
Elevation
Plan
End Elevation
2" Galvanized pipe
6' Track

Complete substation for emergency and maintenance housed on highway trailer—weight 31,500 lb.—wheel loading 4,000 lb.

Manual tap changing is provided on the transformer (see hand-wheels on the tank adjacent to the high-voltage bushings) so connections for the voltages, before enumerated, can be secured without opening the transformer or withdrawing any oil. These changes in taps, however, cannot be made under load.

Arrangement of the post-type disconnect switches and the primary fuses on a low angle-iron framework the controlling mechanism for the breaker, which is solenoid-operated from auxiliary power transformers.

Okonite "Okoprene" cable in four pieces 500 ft. long comprises the portable cable equipment and is of sufficient carrying capacity to accommodate the entire output of the substation. These cables are carried on a two-wheel reel cart having four compartments on the reel. On the rear of the trailer, adjacent to the way road regulations, as are the length and width of the unit.

Due to the arrangement of the wheels and the dual pneumatic tires, the company finds this substation is readily movable over highways and into locations, where there is need for it, with a 2½-ton substation truck. Design and assembly of the unit were done by the engineering and construction forces of the Central Illinois Public Service Company.

Street Lighting Much Increased—Negligible Increase in Bill

Niagara Falls replaces magnetite arcs with 6,000-, 10,000- and 15,000-lumen incandescents — Photo-electric control on all circuits — Develop high temperature cable terminal

C. H. ANDERSON, Buffalo Niagara Electric Corporation, Niagara Falls, N. Y.*

CITIZENS of the city of Niagara Falls, N. Y., now enjoy a 32 per cent increase in lumens at a cost increase of only one-half of 1 per cent as a result of the completion of a planned, long-range rehabilitation of practically the entire street-lighting system.

Niagara Falls, like many other American cities, is a composite of several business districts with residential sections intermingling. There are two main and several secondary business districts.

The old lighting system in the business districts was composed of 4- and 6.6-amp. inverted decorative magnetite arc lamps, mounted at 17 ft. on steel poles that were also used to support trolley guy wires. Four-ampere pendant magnetite arc lamps were used on wood poles in the residential areas between business districts and 6.6-amp., 6,000-lumen pendant incandescent fixtures were used in the outlying residential area.

Lighting Planned

City electrician Adin Chase, who has charge of street lighting, was assisted in laying out a complete street-lighting system for the city of Niagara Falls, covering the main and secondary business districts as well as traffic arteries and residential areas. It was felt that with a definite plan to follow, over a period of years, as different sections were relighted, the city would have a street-lighting system that would be a real asset, by providing adequate light throughout the city, particularly on the traffic arteries.

This program covered all of the business districts (8.3 miles of street), with the exception of one, and 15 miles of residential streets. All of the 1,023 magnetite arc lamps were replaced with incandescent of 6,000-, 10,000- and 15,000-lumen intensities.

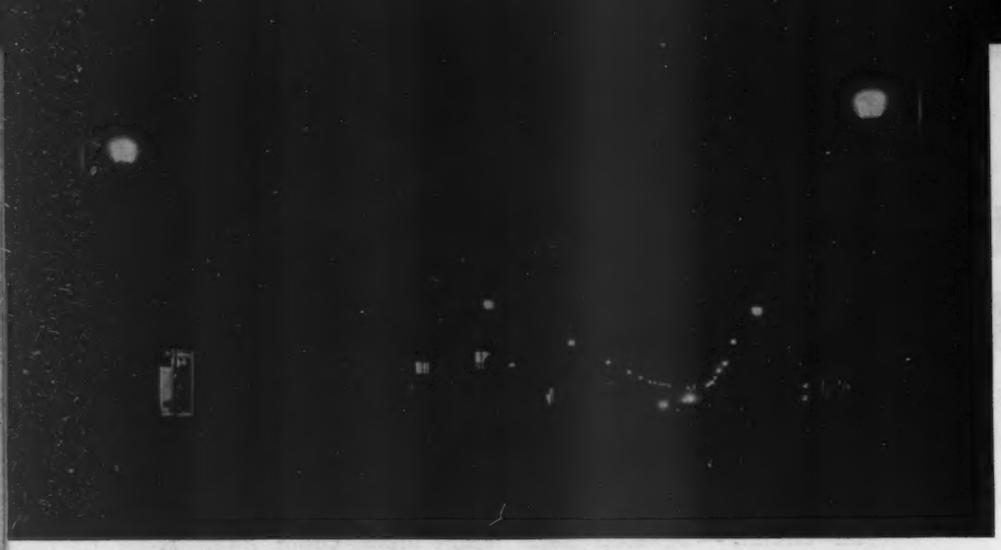
ROUND STEEL PLATFORMS, 3 ft. in diameter, split and hinged, simplified working conditions; luminaires and brackets were assembled and wired at plant

Type of Construction

Since the street railway system has been replaced with buses in the city, it was possible to install the new incandescent lights on the top of the old trolley support poles. A bracket and cap design made it possible to modernize the old trolley poles at a comparatively low cost, to obtain a 22½-ft. mounting height for the luminaires and an inconspicuous method of supporting the overhead lighting circuit.

An insulator to dead-end and break the overhead circuit at each light pole was developed by using an insulator similar to a guy strain insulator with a standard thread pin hole in the center of it. Where it was necessary to use spans over 175 ft. No. 6 triple-braid, weatherproof, three-strand Copperweld wire was used in the overhead circuit. Six thousand lumen lamps were used in the residential and secondary business districts. The lamps were installed in General Electric 72R and 79R pendant type luminaires. Ten-thousand-lumen and 15,000-lumen lamps were used in the main business districts and traffic arteries. These lamps were installed in General Electric 81D pendant type luminaires. Equivalent luminaires

*General superintendent.



GRAPHIC PROOF of street lighting improvement effected on 24th Street, Niagara Falls. Above, results from single, 4-amp., magnetite arcs, mounted 17 ft., opposite spacing 132 ft. Below, results from single 6,000-lumen incandescents, 22½ ft. mounting, 132 ft. opposite spacing

manufactured by the Line Material Company were also used in both the residential and business districts.

Westinghouse subway type series street-lighting transformers (60 kw.) and control equipment were used on the 10,000- and 15,000-lumen lamps. All of the circuits are controlled by photo-electric eyes. Three circuits in the main business districts are controlled from one electric eye, as shown in an accompanying illustration.

Insulation Problem

Installation of the new fixtures was simplified by using round steel platforms approximately 3 ft. in diameter, split in the center and hinged on one end with a clamp connection on the other end. The luminaires and brackets were assembled and wired at the plant. The field work consisted of burning a hole in the steel pole for the circuit and attaching the brackets and overhead circuit to the pole.

The internal wiring in the head of a totally inclosed pendant type luminaire becomes a serious problem when high intensities of illumination are used, particularly 10,000 or 15,000 lumens. Laboratory tests showed that the temperature rise of the wires in the heads of the luminaires was more than 85 deg. C. for 10,000-lumen lamps and over 100 deg. C. for 15,000-lumen lamps. This temperature, combined with voltage, is bound to break down the insulation of the usual 5,000-volt wire used in wiring street-lighting fixtures.

Five thousand-volt conductor No. 8 wire with corona-resisting rubber was used to wire the fixtures. Approximately 7 in. of the rubber was removed and a special partially cured synthetic resin impregnated in ¾x0.01-in. continuous fibre glass tape was wound on the wire to replace the 7 in. of rubber removed.

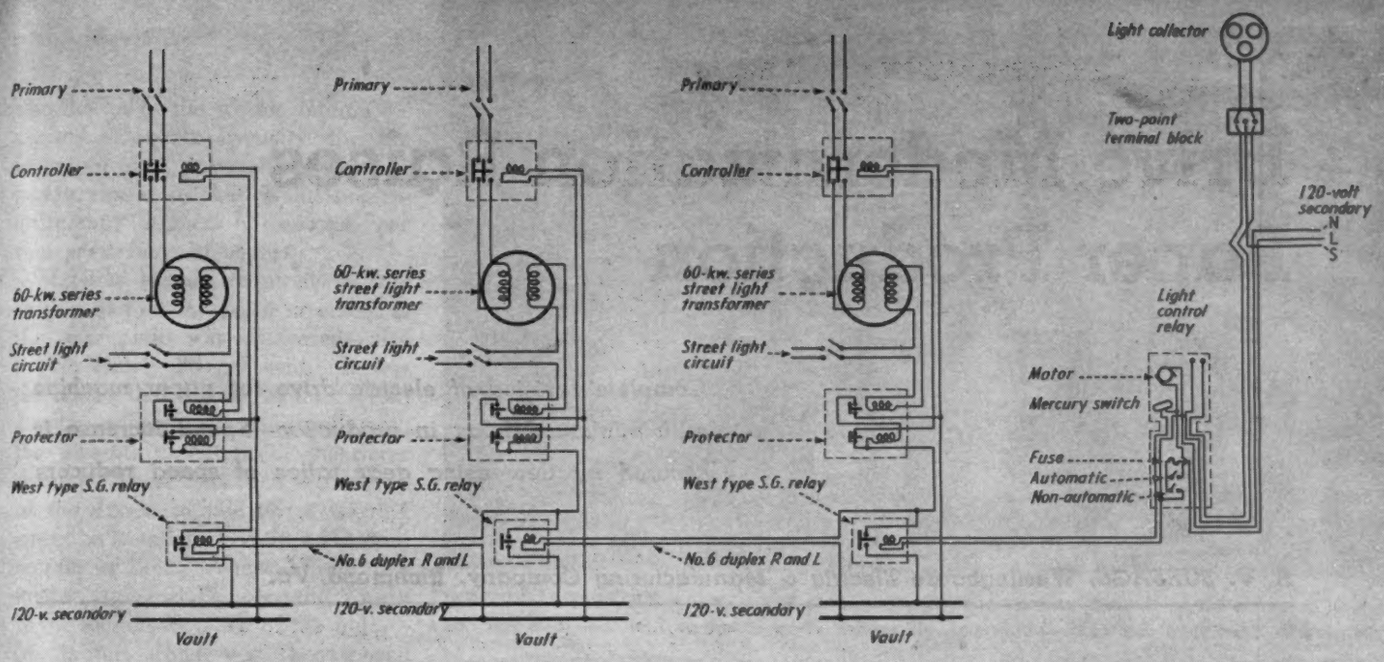
At present not enough time has elapsed to prove from actual field experience that this is the solution to the problem, although all of the laboratory tests, consisting of power-factor reading, moisture absorption and voltage breakdown, after being subjected to abnormally high and low temperatures, showed very favorable results.

Two Economies

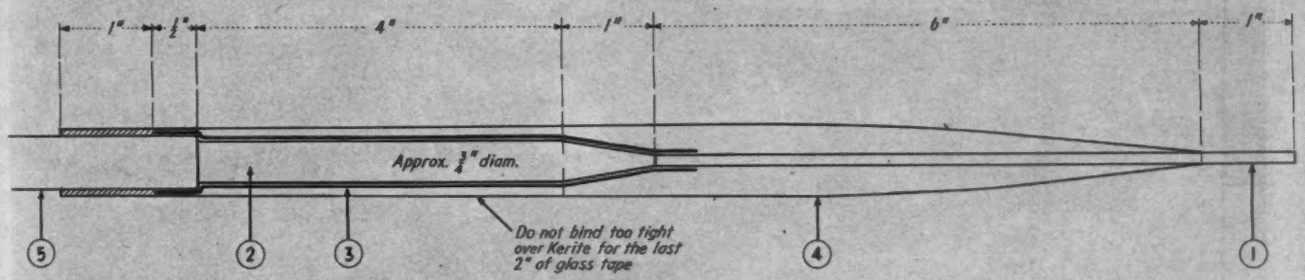
Although the total lumen output was increased approximately 33⅓ per cent from 15,000,000 to 20,000,000, the increased cost of street lighting to the city was negligible—less than one-half of 1 per cent. This was possible by replacing the magnetite arc lamps, which are considerably more expensive to operate and maintain, with modern incandescent lamps. The savings were passed on to the city in terms of more light.

Use of overhead conductors also made it possible for the city to enjoy more light per dollar of cost than would have been possible had underground construction been used. It is interesting to note that when persons have been questioned in regard to the type of street lighting installed in the business districts, the answer has invariably been "underground street lighting." Actually, one overhead wire detracts very little, if any, from the daytime appearance and is one means of obtaining a considerable saving in the cost of street lighting.

Diagram and table on opposite page show the light intensities for both the old and new lighting system. Referring to location "A," 6 ft. from the lamps along the curb line, note that the light intensities were good for both old and new systems, but in the center of the street, half way between lamps at point "B," the light intensities of the old system dropped to a small percentage of the light at "A," while with the new system light intensities are practically constant in the street between lamps.



ALL STREET-LIGHTING CIRCUITS in Niagara Falls controlled by photo-cells; diagram shows three circuits in business district controlled from one electric eye



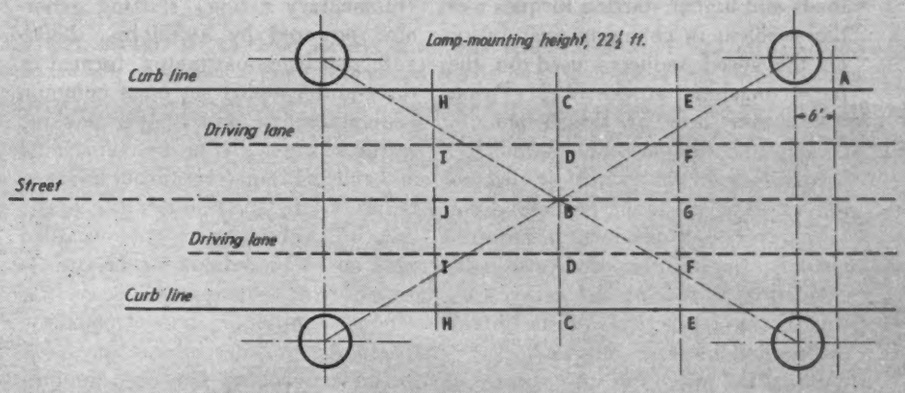
LEGEND

1. No. 8 solid copper conductor
2. 19/64" Kerite factory insulation
3. 1 layer of silk tape, 30% lap
4. Glass tape tightly wound with semi-cured thermal plastic compound to 60% impregnated (S—9639— part 2 of General Plastic Corp.)
5. Kerite braid and tape

High temperature cable termination used with GE type 79-R and 81-D street-lighting fixtures or equivalent, at Niagara Falls

TEMPERATURE RISES of 85-100 deg. C. in 10,000-15,000-lumen totally inclosed pendant luminaires led to development of this cable terminal using synthetic resin and fibre glass tape

DATA ON STREET-LIGHTING INTENSITIES under old and new systems at Niagara Falls; equipment used to take illumination intensities consisted of three "Electrocell" barrier-layer cells in parallel and a suspension type galvanometer



Readings below are Representative of the Three Different Intensities of Lighting Used in Various Business Districts

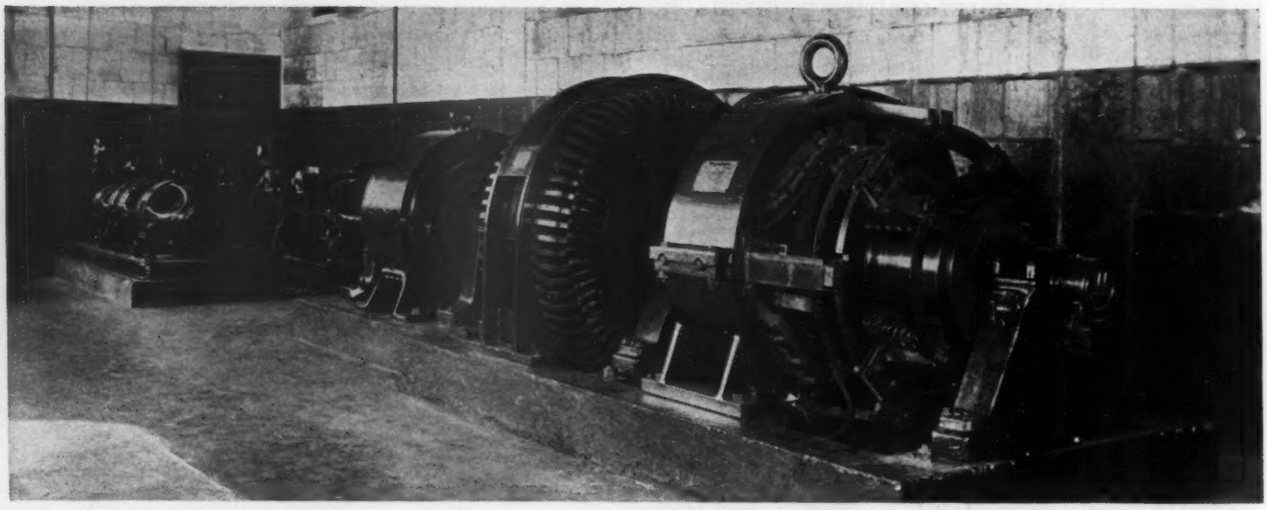
Street	Number and Type of Light on Pole	Spacing	Width of Street	Foot—Candle Intensities									
				A	E	C	H	F	D	I	G	B	J
OLD Falls St.	2-6.6 amp. Magnetite	Opposite 70-ft.	67-ft.	2	—	—	—	—	—	—	—	.1	—
NEW Falls St.	2-15,000 Lumen Incd.	" "	"	2.87	2.2	2.64	2.52	3.75	3.08	3.4	2.5	2.75	2.75
OLD Niagara St.	1-6.6 amp. Magnetite	" 125-ft.	44-ft.	.5	—	—	—	—	—	—	—	.04	—
NEW Niagara St.	1-15,000 Lumen Incd.	" "	"	1.16	1.0	.48	.88	1.9	.63	1.7	2.12	.65	1.9
OLD 24th St.	1-4 amp. Magnetite	" 132-ft.	43-ft.	.28	—	—	—	—	—	—	—	.04	—
NEW 24th St.	16,000 Lumen Incd.	" "	"	.68	.29	.18	.3	.83	.27	.64	.74	.27	.84

NOTE — In all cases the highest intensities are in the desirable locations, the driving lane, and in the center of the street.

Drive Modernization Raises Paper Production

Complete revision of electric drive for paper machine with minimum delay in production—Speed increase is secured by decreasing gear ratios of speed reducers

A. V. BURBAGE, Westinghouse Electric & Manufacturing Company, Richmond, Va.



OLD 500-KW. "RUNNING" GENERATOR supplying driving motors was converted to "starting" unit by addition of new interpole field coils to provide 2,300 amp. momentary starting current; can also provide standby service

HOW TO HANDLE the increased loads and higher starting torques was the problem in changing gear ratios on the speed reducers used on the paper machine at the West Point, Va., paper mill of the Albemarle Chesapeake Company. Economically, it was desirable to modify or revamp the existing sectional electric drive to fit increased production requirements. Engineering analysis indicated that decreasing the gear ratios was the most practical way to obtain the wanted increase of speed.

When the mill went into operation in 1930 the 240-in., 150-ton Pusey & Jones Fourdrinier paper machine was driven by a Westinghouse variable-voltage sectional electric drive, designed for an operating range of from 100 to 850 ft. per minute. At that time a 500-kw., 600-volt d.c. running generator and 1,600-amp. (momentary rating) starting generator powered by a 750-hp., 2,300-volt synchronous motor formed a three-unit coupled set on a common bedplate. The nine paper-machine sections were driven by individual 600-volt d.c. motors through speed reducers. In 1935 an additional section of twelve dryers was installed (geared to the existing gear train), driven by a 70-hp. motor.

This additional drying capacity, together with other improvements on the paper machine, increased the output to approximately 170 per cent of the initial capacity. Because production requirements demanded that more and more runs of nine-point paper be run at 850 ft. per minute, it seemed feasible to step the speed up to 1,050 ft. per minute on paper of this weight. While the dryers were adequate for production at higher speeds, the sectional drive was revised, with the idea that sixteen more dryers ultimately would be installed, to provide for a possible increase in output of heavier papers.

Paper machine was satisfactory for operation up to 1,100 ft. per minute without major expenditures, so by decreasing the gear ratios to obtain this speed the loading on the section motors and generators increased in direct proportion, or approximately 30 per cent. Somewhat higher loading would be expected on the couch because of the increased vacuum required to remove water at the higher speeds. A daily log record for the past nine years was available for all motors and generator loads for various speeds and paper weights.

The design of the section motors indicated adequate capacity for the increased load, provided the machine was operated so that it did not require any higher horsepower per foot per minute of paper.

Starting torque required by the section motors increased inversely as the gear ratio was decreased—also approximately 30 per cent. It was calculated that all the motors would develop sufficient starting torque with the possible exception of the dryer section. There had been a tendency of the dryers to pile up at starting since the installation of the additional section in 1935. A new 175-hp. d.c. motor was installed on the fourth dryer section in place of the old 70-hp. motor, which was then moved toward the wet end, where an intake shaft on the dryer train was available. This move provided additional starting torque and corrected the tendency of the dryers to pile up toward the dry end.

From a careful study of the gearing it was found that gear parts from the first dryer could be used on the couch. Likewise, the gear parts from the first press were used on the reel.

Provide for Future Load

A unique arrangement was worked out on the power units to handle the additional load plus the future dryer load. A new generator of 750-kw. capacity, driven by a 1,100-hp. synchronous motor, was used as a running generator. The old 500-kw. "running" generator was converted into a "starting" generator by the addition of new interpole field coils to provide 2,300 amp. momentary starting current. The old starting generator was used as a running generator for the winder drive to provide additional capacity for this stepped-up operation. Flexibility of this arrangement is apparent in that complete standby is now provided at decreased paper speeds by reverting to the original operating set-up.

Four motors on the dryers introduced two problems. In order to reduce the initial inrush of current on the starting generator the four motors would be started in series and automatically reconnected in parallel for accelerating and running. For the motors to divide a common load operating in parallel it was necessary to provide sufficient compounding to prevent load shifting. On the other hand, it is necessary to have a flat speed characteristic of the driving motors in order to secure good differential speed regulation as required on each section of the paper machine. Both of these desirable conditions were satisfied by using a special combination of cumulative and differential series field winding with equalizer connection. The cumulative section is effective for each motor up to the equalizer connection. From this position it is neutralized by the differential winding so that the over-all performance of the four motors is similar to a motor having a comparatively flat speed-load characteristic.

Speed regulation was the second problem presented by the fourth dryer motor. The carbon pile speed regulator on the dryer section was initially designed to handle the field current of two motors. With the addition of the third motor in 1935, and the proposed fourth motor, the field values would be considerably in excess of the regulator capacity over the broad range of operating speeds and wide range of operating load conditions. A small 15-amp. motor-driven pilot exciter set was used. This small exciter serves to buck the voltage of the main exciter and the carbon pile regulator operates on the booster exciter field instead of directly on the field of the motors. This booster exciter materially increases the range

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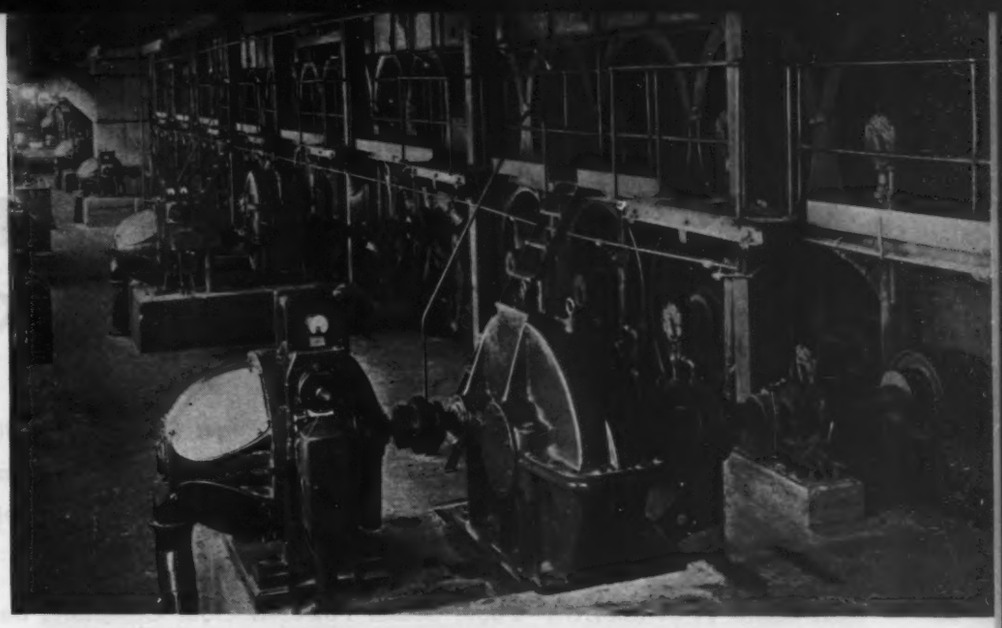
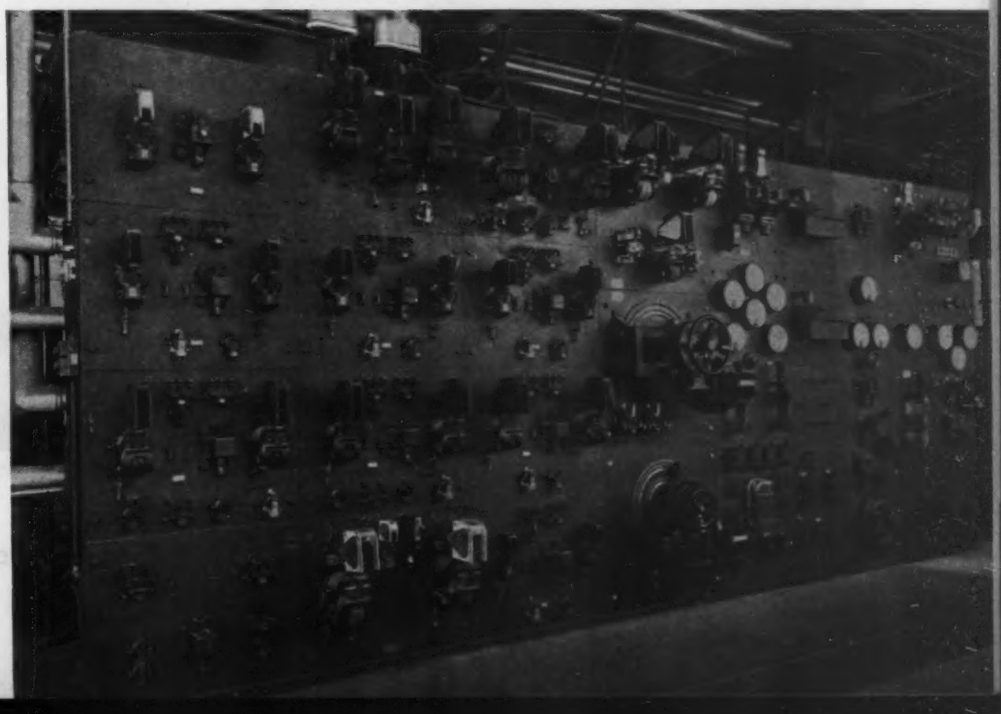


INDIVIDUAL 600-VOLT d.c. MOTORS drive paper machine sections through speed reducers: new 175-hp. unit and gear unit on fourth dryer section (in foreground) provided additional starting torque

CONTROL BOARD for sectional electric drive was modified to make use of new 750-kw. motor-generator set, an additional dryer section and certain other revisions of this paper machine



Revenues Increase 45 per Cent Under Commercial Cooking Plan

Puget Sound gains 80 per cent increase in sales from 9,800 kw. of new commercial load added in past four years through completely organized, executed campaign

CHARLES T. BAKEMAN,* Puget Sound Power & Light Company, Seattle, Wash.

DURING the 3½ years that the Puget Sound Power & Light Company has been aggressively promoting commercial electric cooking annual kilowatt-hours delivered to commercial cooking and heating customers have shown an 80 per cent increase and revenue a 45 per cent increase. This establishes a new high for us in rapid load development for any one class of business, especially when it is considered that some five million annual kilowatt-hours were already being delivered to this class of customer 3½ years ago. The forces which have so rapidly increased sales in this field can be readily traced to a selling plan fitted to this market. Briefly, these forces are competitive costs, a trained sales organization, modern equipment, an aggressive selling plan and promotional advertising support.

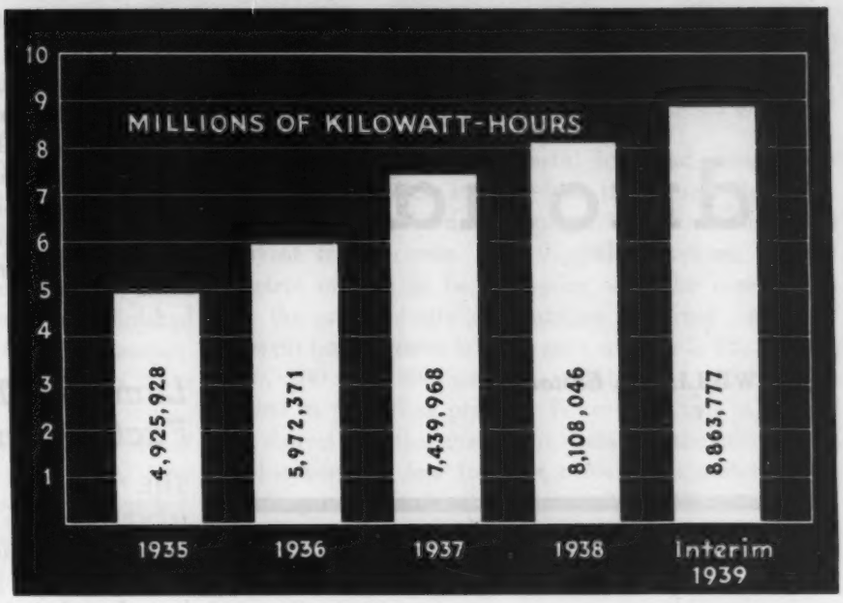
*Commercial and industrial sales director.

Our effort in developing this commercial cooking load dates back to some fifteen years ago when a survey of the commercial cooking and heating market possibilities was made in several district areas. At that time very little was known of the kilowatt-hour market possibilities of this field. Sketchy as the survey was, it definitely pointed to commercial cooking as the major immediate market in the commercial heating field. As a result of our preliminary efforts it was soon evident that our regular commercial lighting and power rates were ill adapted to this commercial cooking load and that this load had characteristics that would economically justify a rate more nearly competitive to other types of fuel.

In 1929 the first important step was made with the filing of a special commercial cooking and heating rate, designed to serve more satisfactorily existing business and to attract new business. This was a simple block rate with minimum charge based on kilowatt demand. It was designed to collect revenue on the basis that restaurant men feel justified in paying. The lower steps of the block rate provided a strong promotional effect for complete electrification where essential small electric appliances had

INSTALLATION IN OUTSTANDING HOSPITAL of the Northwest includes main kitchen (shown above), diet kitchen and all-electric bakeshop; cooking load above totals 124 kw.

already been installed. Because of the characteristic low demand ratio to connected load of this business, the minimum charge was based on kilowatt demand without reference to connected load. High diversity between commercial customers and the off-peak characteristics of a large part of this load justified a kilowatt-hour rate that was more nearly competitive to other types of fuel.



COMMERCIAL COOKING AND HEATING SALES by Puget Sound Power & Light Company

Competitive Rate

During the first ten years of our commercial cooking development no attempt was made to organize specifically for this selling, this business being handled as an incidental item by domestic salesmen and power salesmen. In spite of this, an annual load of some 5,000,000 kw.-hr. had been built up. In 1935 a study of this load was made and it was found that no increases had been obtained over the last four years. In fact, with competitive fuel prices having been reduced and with an increased competitive selling activity, 1935 showed a 7 per cent reduction of kilowatt-hour sales under 1934 and was lower than sales had been for 1932. At that time it was decided further to adjust our cooking and heating rate and to organize our selling efforts to reach this market more effectively. A careful analysis of the rate necessary to obtain and hold this business and the cost of service was made, and as a result a rate reduction was made. The new rate was designed to provide the maximum promotional efforts consistent with a reasonable rate for this class of business.

At the same time a sales organization was developed consisting of five part-time commercial cooking and power men and one full-time cooking man, headed up by a general office sales director. These men were given a thorough school training before being sent on the job, followed with a continuous plan of field training. The rate reduction and the sales organization were established almost concurrently and proved to be the two most important steps in developing this load.

As a result of these first two steps the sales of commercial cooking and heating kilowatt-hours changed from a reduction in 1935 of 7 per cent under 1934 to an increase in 1936 of 17.5 per cent over 1935. Reduction in revenue previously experienced was arrested, with 1936 revenue practically equal to 1935 and the entire rate reduction regained in nine months initial selling effort. Kilowatt-hour delivery for 1937 showed a 51 per cent increase over 1935 with

[*Continued on page 124*]

FOUR OUT OF FIVE COMMERCIAL FOOD SERVERS on Puget Sound lines use electric cooking; this Seattle spot's counter equipment includes two fryers, two broilers, two coffee makers and toaster

Editorials

S. B. WILLIAMS, *Editor*

Our Largest Systems

TWENTY-SEVEN YEARS ago ELECTRICAL WORLD started its annual reporting of the peaks and output of the largest utility systems. But five companies were included and their peaks for 1912 ranged from 42,500 kw. of Brooklyn Edison to 233,000 kw. of Commonwealth Edison.

This year, in our 28th annual survey, which appears in this issue, the largest single peak is six times as large as the largest in the first survey and the output ten times as large. Thus has the industry grown.

The first complete report for all systems with outputs exceeding one hundred million kilowatt-hours covered 1914—a quarter of a century ago. There were thirty-three American and one Canadian systems. In the two years from 1912, when the first data appeared, both the peak and the output of the largest system had increased nearly 50 per cent. The increase in peak of the largest system last year was but 7.4 per cent over 1938. However, that one-year increase was 25 per cent larger than the two-year increase twenty-five years ago.

That is something that people fail to grasp when talking about growth in this industry. Growth when taken as a ratio is misleading except to strong minds. It is difficult for most people to throw off the mesmerism of large percentage gains.

Growth in utilities has been steady, but on the absolute basis. Growth, in other words, is an arithmetic and not geometric progression.

It is not possible to compare from our annual survey system for system over this period because of mergers and expanding territory. Unfortunately, also, those early years gave no data on system generating capacity, so that utilization comparisons cannot be made. Load factor, however, can be worked out. In 1912 the average was in the low thirties. Two years later it was 47.7 per cent. Last year 54.5.

Indications are that over a two- or three-year period this figure has about established a level. Last year it showed a marked gain over 1938, but that was only because output had risen much faster than capacity. Next two years' data, however, considering the large capacity increase scheduled for this period, might easily show a drop.

This annual survey of large systems is probably the oldest annual statistical survey in the industry. Its continuity has been possible only through the co-operation of the reporting companies. It is a service which ELECTRICAL WORLD has been proud to give.

Luminous Tube Power Factor Correction

THE ADVENT of fluorescent lighting has served to refocus attention upon power-factor correction for all luminous tube installations. While some utilities are depending upon penalty clauses to keep down the number of undesirable installations, the trend appears to be toward insisting that no new or altered installations be permitted unless the power factor is up to some acceptable figure. It has been found that it is much easier to get correction at installation than to collect penalties. Also, being done at one time, there is no future nagging and haggling over penalties for failure to correct power factor.

Poor power factor in luminous tube installations, which is inherent in the transformer, can be corrected by adding capacitors of the right size and voltage, or by using a high-power-factor transformer. This latter method is in effect nothing more than fitting capacitors and transformers together so that the capacitors operate at a voltage sufficiently higher than tube supply in order to secure the maximum improvement most economically.

The trend in fluorescent lighting is definitely toward equipments provided with power-factor-correction devices by the fixture manufacturer. With luminous tube signs, however, there appears to be greater necessity for installing corrective devices on the job.

This has been a problem in the past because of the cost. The transformer in the case of the skeleton type window sign, for instance, might run up to 30 per cent or more of the total cost of the sign. If to this was added half again as much for a high-power-factor transformer the whole thing frequently became top-heavy. In fact, it sometimes looked as though the cure was worse than the bite.

Readjustment in price, however, has so narrowed this difference that now high-power-factor transformers add in excess of low-power-factor unit cost at the most only about 10 per cent, and in the case of large roof signs as little as a half of one per cent, to the total sign cost.

Utilities now can be more insistent on high-power-factor luminous sign installations without facing customer objections as to prohibitive cost, particularly with the incentive of nearly 90 per cent power factor against an otherwise 50 per cent.

The Butcher, the Baker the Candlestick Maker

"GREAT FLEAS have little fleas upon their backs to bite 'em, and little fleas have lesser fleas, and so on *ad infinitum*."

We were reminded of this familiar quotation from "A Budget of Paradoxes" when studying the effect of this year's enlarged utility construction budget. There are construction workers, finished and semi-finished material workers, raw materials workers and transportation workers. These directly affected workers have dependents.

To feed, clothe, shelter and amuse this army of people takes another army, and they, in turn, have their human wants to be filled. There's the "butcher, the baker, the candlestick maker," all working for the families of the people who are engaged directly in this construction program.

And as you study the figures you soon realize that there are only a few basic operations in a national industrial economy such as ours. If any one of these is prevented from pulling its weight the entire economic and social fabric of the nation suffers.

It will probably never be possible to trace the full effects of any kind of spending, but in our June 1 issue enough of the ramifications of the effect of the construction expenditures — Dinner-Pail Dollars — will be developed to give one an idea of the part it plays in our whole national employment program.

You will be surprised to see how many policemen, letter carriers, teachers, salespeople, doctors, yes, and even bill collectors, would be out of luck if the utilities had no construction budget—if Dinner-Pail Dollars ceased to circulate.

Current Transformer Rating Standardization

RESEARCH on magnetic and thermal materials and design of new bearing materials laid the foundation for extended accuracy range of watt-hour meters. This has already been reflected in the smaller number of ampere ratings of watt-hour meters required to meet the wide range of customer loadings encountered by utilities. One benefit is in the smaller variety of stocked meters and another is in the saving in cost through less frequent change to larger ratings as particular loads grow.

Though fewer in number, there is nevertheless a comparable benefit to be derived in connection with the larger loads—industrial and commercial—which require current transformers. These loads, too, are showing the characteristic tendency to grow and demand increased metering capacity. Some seventeen ratings of current transformers from 5 to 1,200 amp. are today prevalent to cover the range of metering installations at most common primary voltages for such loads. It would help effect the same kind of stocking and replacement savings attained with watt-hour meters if the number of required current transformer ratings could be cut in two.

Characteristics of magnetic iron and design proportions have been improved so that longer flat accuracy from light load to overload is now obtainable in current transformers. It is logical, therefore, for the electric utilities to be discussing with the manufacturers the practicability of confining preferred ratings of current transformers to some such steps as 5, 25, 50, 100, 200, 400 and 800 amperes, eliminating other ratings found in prevailing practice. Fewer sizes will be carried on shelves of either makers or users and the utility users will experience less frequent occasion to switch up as loads grow.

Local Schools to Iron Out Fluorescent Kinks

NOW that the utilities' position on fluorescent lighting has been clarified the next step is to co-ordinate the selling of this new lighting tool by all agencies to the end that confusion such as has existed will be reduced to the minimum. The best approach that has been found is through a fluorescent lighting school. These schools may be held under the auspices of the local electrical league or, if none exists, the power company.

Several cities have held such schools and the reports have been very satisfactory. The Chicago school, for instance, which was the first of its kind, had in the five days an attendance of more than 1,200.

These schools are primarily for the purpose of educating the people who are contacting the customer, namely, utility salesmen, representatives of contractors, jobbers, manufacturers, architects, inspectors and engineers. There is no reason, however, why representatives of important customers such as large stores and certain industrials might not attend. In fact, that might be one way of convincing them of the sincerity of the utilities in promoting fluorescent.

Unlike incandescent lighting, with its broad background of experience, so little is known about fluorescent that each school must find local men who will dig for everything there is to be had on the subject. By so digging these leaders will be educating themselves as well as those who attend the school, and in that way will form the nucleus for a well-co-ordinated selling front.

For that reason it has been found well worth while to have a large number of people take part in the presentation of the subject, having at least one alternate for each part of the subject to be presented.

When the local people are well informed on the proper application of fluorescent, its cost in relation to incandescent and its possibilities in terms of better light intensities the utilities will find fewer causes to complain of improper selling.

Robbing Peter to Pay Paul

By CARTER FIELD

This noted journalist gives his personal comments and interpretations on current happenings affecting the electrical industry. His background and his location at Washington make his thoughts informative and interesting even though all may not agree with him

"WATCH Tacoma Grow!"

Does that tickle a memory? It probably does if you were interested in the rivalry of Northwestern cities a few decades ago.

Remember "Mount Tacoma"?

That's the spectacular peak officially called Mount Rainer. But Tacoma, ablaze with civic pride and determination to outstrip even San Francisco and Los Angeles, was going to change its name to Mt. Tacoma.

High among its attractions to prospective settlers, as the civic leaders of Tacoma envisioned the future, was the municipally owned and operated electric plant. Then, as now, Tacoma boasted the lowest electric rates in the United States. No wicked power barons were to loot its workers or its factories. It was going to march forward to be the metropolis of the Northwest, maybe of the whole Pacific Coast.

The Dead Hand

But as the years rolled by Seattle and Portland, its nearest rivals as ports, and Spokane, its rival for second place to Seattle in Washington, have far outstripped the once proud Tacoma. What could have happened?

"The dead hand of public ownership," says Representative George H. Bender of Ohio.

Mr. Bender had been talking about TVA. He went into details about the huge federal subsidy poured into that region and the pitiful results, so far as uplifting the state or attracting new industries are concerned. He quoted the Blue Book of Southern Progress to the effect that in 1938, of $143,775,000 invested in the South that year, Tennessee was listed last, with only $548,000, whereas on a population basis Tennessee's share should have been $8,626,600.

The idea running all through Mr. Bender's comparisons is that public ownership spells high taxes, and that it's not just taking one dollar out of one pocket and putting it in another, for the increase in taxes, wherever government ownership enters, seems to zoom out of all proportion to the reduction in electric rates. He shows this not only in comparing Tacoma to Seattle, Portland and Spokane, but also in contrasting Toronto with Buffalo, both of which use Niagara power, Toronto with a government-owned system and Buffalo with a private, and also in contrasting the growth of debt between the province of Ontario with that of the neighboring province of Quebec.

All of which is enormously interesting to the booster of any particular city, because it is the electric rates of Tacoma and Ontario which are always cited by the John Rankins of the public power movement.

"Would it be fair to suggest that the true motive behind all this blather about cheap power is not honest concern for the welfare of the workingman, but the greed for bureaucratic power of politicians who wish to create a great federal political machine by TVA-izing the nation?" Mr. Bender inquires.

The Drag of M. O.

"Tacoma has had a municipal light plant for 47 years," Mr. Bender says. "It had available cheap water power sites and has enjoyed unusual non-political management.

"Back in 1890 Tacoma had a population of 36,000. It was situated on one of the finest deep-water sounds on either coast, with a rich back country to draw upon. It was blessed with enormous resources of lumber and water power. At that time, back in the semi-arid 'jackrabbit' country of Washington, 300 miles and a range of mountains from the seacoast, struggling young Spokane had a meager population of 19,992. Today Spokane has outstripped Tacoma, with all of its natural advantages, and has a population of 115,514, while Tacoma, once twice its size, now boasts but 106,817 population. Tacoma for the past 47 years has had the glorious benefits of public ownership. Spokane has been served by a private company. The private company pays 18½ per cent of its gross in taxes and still sells its power at an average of 2.1 cents per kilowatt-hour for domestic consumers and sells a third more power to the average consumer than does TVA.

"In 1936 the net public debt was $127 per capita in Tacoma, while Spokane's debt was only $33 per capita. The total Spokane tax rate, 1939, was $44.70, while Tacoma's was $57.72, both with the same assessment ratios.

Tax Inequities

"And mark this: Tacoma's average residential use of power, despite its slightly cheaper rates, was 1,900, as against Spokane's 2,300 average use per customer.

"At a rate hearing before the Oregon Public Utilities Commission at Portland recently uncontested evidence was produced showing that Northwestern Electric Co., serving part of Portland and suburbs, with a fixed capital of $21,000,000, had paid $8,868,000 in taxes since its formation 25 years ago. Alongside that record was Tacoma's $24,000,000 plant account, on which it had made tax contributions totaling $2,678,788 in 47 years. On the relative basis it should have contributed 16 to 17 millions of dollars over that period. Last year the Northwest Electric paid $731,000 in taxes, Tacoma about one-third as much, or $248,000.

"Taxes being more important in the growth of a city than power, Tacoma lagged behind, while Portland, equally favored by nature, but with private ownership and lower taxes, leaped to a dominating position."

In Toronto, Mr. Bender continued, the annual light bill of a family is about $7.50 less than the same family would pay in Buffalo. But if

[*Continued on page 132*]

NEWS OF THE WEEK

Chattanooga Finds T.V.A. Contract Blocking Funds

Facing curtailed services, efforts of city to get $200,000 surplus from electric system hinge on TVA policy, city attorney says — State Senator challenges contract

Repercussions of the TVA tax-replacement legislative discussion in the nation's capitol were reflected in Chattanooga last week as former State Senator F. R. Morgan challenged the right of the city's Power Board to assign "surplus" revenues under a TVA contract which prevents use of these funds for city expenses.

The city's budget reached a crisis recently, according to a story in the Chattanooga *Times*, when two or three commissioners announced they would have to curtail services unless their departmental budgets were supplemented. School term would be reduced, it was said, unless $33,000-$43,000 was forthcoming.

Who Gets $200,000?

Center of contention is $200,000 which the Power Board announced was a surplus. "It was part of the campaign propaganda," ex-Senator Morgan states, "and part of the campaign itself that the acquisition by the city of Chattanooga of its electric distribution system would go a long way toward relieving the tax burden upon real estate."

Since publication of the Power Board statement disclosing a $200,000 surplus, Senator Morgan states many people have called upon him demanding that the surplus be placed in the general funds of the city as was their understanding when the enabling legislation was drafted and enacted.

In response to a request from Mayor E. D. Bass for an opinion, City Attorney Joe Anderson has cited a contract between the city and TVA which provides that funds must be used to retire bonds or to reduce rates before they may be used to pay general obligations of the city.

It will be necessary, therefore, for the city power board and TVA directors to reach an agreement, Mr. Anderson advised, that the surplus funds cannot "practicably" be used for rate reductions before such revenue will be available.

Stating that "there were many fine people in the city of Chattanooga who sincerely doubted the advisability of the city going into the power business," Senator Morgan stated that the people should know if provision 5 of the act is meaningless and will not be followed.

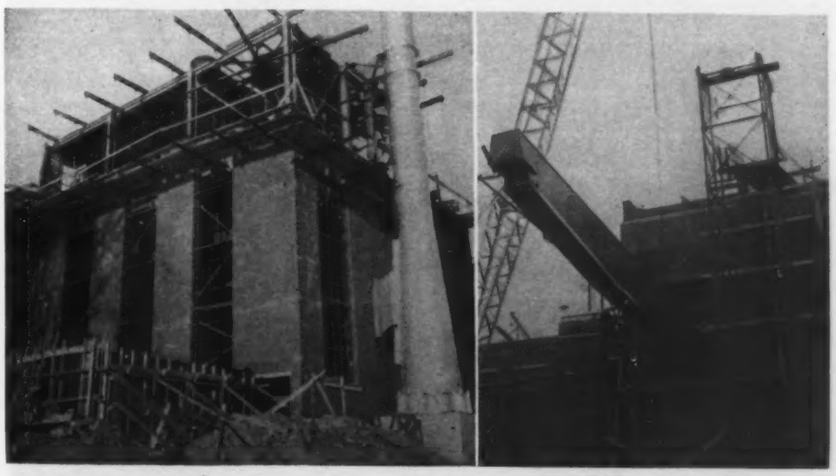
Power Sales Groups Convene at Roanoke

More than 250 utility men from companies located in 28 states and in Canada were present at the Edison Electric Institute Industrial Power and Heating Sales Committee-Southeastern Electric Exchange Conference, held at Roanoke, Va., April 24-26.

Harris E. Dexter, E.E.I. sales committee chairman; H. M. Sawyer, American Gas & Electric, and Charles A. Collier, Georgia Power, spoke to the assemblage on topics designed for men on the firing line of power sales work. Charles E. Ide, president of the Southeastern Exchange, was present for most of the sessions.

Power service in all its aspects, new business procedures, new aspects of competition in the field of purchased power, new applications such as infrared and fluorescent were among the subjects discussed.

Edward M. Clapp of Georgia Power was in charge of sessions sponsored by the exchange and C. H. Purdy of Consumers Power was in charge of the E.E.I.-sponsored sessions.



NORWICH ADDS UNIT—A 10,000-kva. G.E. turbo-generator is being added to the plant of the Norwich, Conn., municipal lighting department. New oil-fired Riley boiler (100,000 lb. per hour) goes in plant extension at left and 20-ton crane (right) is swung through window opening to be set in place. Consultants Arthur L. Nelson Co., Boston

Broader Operating Field Seen for North American

President Shea at annual meeting says company's interests not limited to traditional utility investments — Construction for 1940–1941 totals $61,000,000, with 1940 double previous year

A broader field of operations and developments for the North American Company which would be outside the sphere of utility operations was announced last week by E. L. Shea, president, in a prepared statement delivered at the annual meeting of stockholders held in the New York offices on April 25.

Queried on this point after the meeting, President Shea, a former oil man, told ELECTRICAL WORLD that in the first fifty years of its existence the North American Company was built by imagination and vision which sought out new opportunities. It is up to us, the present management of North American, he said, to continue the company's growth through the next fifty years by using the same imagination and vision to seek out new opportunities for that growth.

Serves Industry

"The function of this company is to supply needed capital for the operation and development of American industry," Mr. Shea told the stockholders, "and to diversify our investment widely enough to insure both safety and a reasonable return on our money. Because of this primary function, I know of no reason why our capital is necessarily limited to investments in utility properties alone. We started out primarily interested in transportation; we saw opportunities to serve the public and make a return on our investments in the then infant electric business. Thus, if today or tomorrow an opportunity were offered to develop in another field which promised to produce more of the things the people of the country need and want and at the same time enhance and protect the interests of our stockholders, we would not feel that tradition would stand in the way of our availing ourselves of such an opportunity."

About eighty people attended the meeting, consisting of stockholders, employees of the home offices, and officers and directors of North American and of operating companies. Annual reports had been previously transmitted to stockholders, and as practically no questions, queries or criticism developed at this year's meeting, comments were confined to Mr. Shea's statements. With 59.29 per cent of the preferred and 62.49 per cent of the common stock voting, the present management was continued.

Pointing out that Section 11 of the Public Utility Holding Company Act may be contrary to the public interest, Mr. Shea stated that as matters stand today the practical application of the integration provision of Section 11 to a holding company system such as North American poses questions which are not yet answered. In summarizing, Mr. Shea said: "In other words, we are going to comply fairly and in good spirit with the law of the land, and we are voluntarily going to take all such steps toward that end as may, from time to time, appear requisite. At the same time we are going to reserve all rights to protect the interests of our security holders under that same law of the land."

1940-41 Construction

To be ready to meet the growing needs of the communities they serve, Mr. Shea said North American properties are engaged in construction programs involving expenditures of approximately $61,000,000 in 1940 and 1941. The cash expenditures in 1940 will be almost double the aggregate of the expenditures by the same companies in 1939. Work has started on the new 80,000-kw. plant in Venice, Ill., across the Mississippi River from St. Louis, and the new 60,000-kw. plant in Cleveland and on the 35,000-kw. addition to one of the plants in Milwaukee, all of which will be ready for operation next year, Mr. Shea said. In the Kansas-Missouri group a new 15,000-kw. plant will be in operation this year and a 5,000-kw. addition to an existing plant. Later this year, he said, a 50,000-kw. addition to one of the plants in Washington, D. C., will be in operation.

177 TONS GETS GOING—On its way to Commonwealth Edison's Crawford station in Chicago is this 355,000-lb. synchronous condenser rotor, shown here ready to leave the East Pittsburgh works of Westinghouse

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Wisconsin Co-Op Ceases $1,200 Transmission Bill

The Chippewa Falls (Wis.) 3,500-kw. Diesel plant of the Wisconsin Power Co-operative, largest REA-financed generating system now in service, has just discontinued the $100 per month or $1,200 annual transmission charge imposed upon each of the twelve member distribution co-operatives after each has taken service for a year.

Cost of generation in this plant, serving 17,000 members of the co-operatives, is said by REA to average 8.2 mills per kw.-hr. at the busbar. After line losses and transmission expenses the cost at distribution side of substations is reported to be 1.39 cents. The above reduction will drop the cost to 1.25 cents per kw.-hr.

E.E.I. Convention to Cover Wide Field

Less than thirty days hence utility men from all over the United States will be lining up at registration desks at Atlantic City to sign up for the eighth annual convention of Edison Electric Institute to be held June 3-6. C. W. Kellogg, president of the institute, has extended a cordial invitation to all electric utility companies, including non-members of the institute, and to electrical manufacturers to attend the convention, which will comprise five regular sessions, a luncheon meeting and an evening meeting, covering a wide variety of speakers and subjects.

Speaking on subjects of broad general interest will be Howard Coonley of National Association of Manufacturers, Dr. Lionel Edie, a consulting economist, and Col. Robert S. Henry of the Association of American Railroads. Electrical manufacturers will be represented by Ralph Kelly, vice-president Westinghouse Electric & Manufacturing Co., and Charles E. Wilson, president of the General Electric Co.

The institute is calling attention to the new low fares which the railroads have placed in effect, the optional privileges allowed by the railroads with respect to diverse routes and the schedule of special rates for delegates at Atlantic City hotels. Friday, June 7, has been designated Edison Electric Institute Day at the World's Fair and a special train will be operated from Atlantic City to New York to transport convention delegates directly to the fair.

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Substantial Increase in Appliance Sales

Sales results show March to be a month of outstanding achievement for ranges and water heaters. Figures compiled for sales made by the members of the Inland Empire Electrical Equipment Association show a 223 per cent increase in sale of water heaters for March, 1940, over March, 1939. Range sales climbed 131 per cent for March, 1940, over the same period in 1939. March, 1940, sales of ironers show a 118 per cent increase over the same period in 1939. Refrigerators show a 52 per cent increase, roasters 58 per cent and clothes washers 27 per cent for the same period.

The first three months of 1940 show substantial percentage increases in major appliances over the same period for 1939, as follows: Home ventilating 159, oil burners 292, water heaters 168, ranges 57, stokers 38, refrigerators 58.

Program Eighth Annual Convention Edison Electric Institute

Committee Meetings—Monday, June 3

General Accounting Committee, 12:30 p.m.—Luncheon meeting. To be followed by possible specialized group meetings. Rate Research Committee, 10:30 a.m. General Sales Committee, 12:30 p.m.—Luncheon meeting. Executive Committee, Modern Kitchen Bureau, 3 p.m.

Tuesday, June 4

Operating Committee, 1 p.m.—Luncheon meeting.

Wednesday, June 5

Board of Trustees, 1 p.m.—Luncheon meeting.

First General Session—Tuesday, 9:30 a.m.

Call to Order.
Report of Treasurer.
President's Address—C. W. Kellogg, E.E.I.
Address (title to be announced)—C. L. Campbell, Connecticut Light & Power Co.
Address (title to be announced)—C. E. Wilson, General Electric Co.
Economic Trends in the Electric Industry—Edwin Vennard, Middle West Service Co.
Adjournment.

Second General Session—Tuesday, 2:30 p.m.

Power Generation Advances—E. L. Hopping, Philadelphia Electric Co.
Continuity of Service as Related to Its Cost and Value—H. R. Woodrow, Consolidated Edison Co. of New York, Inc.
Human Problems of the Utility Industry—Paul M. Downing, Pacific Gas & Electric Co.
Address (title to be announced)—George Ousler, Duquesne Light Co.
Experience Rating for Unemployment Compensation—B. W. Leach, Unemployment Benefit Advisors, Inc.
Adjournment.

Third General Session—Wednesday, 9:30 a.m.

Report of Nominating Committee and Election of Trustees.
More and More for Less and Less—H. L. Wallau, Cleveland Electric Illuminating Co.
The American Way of Work—Ralph Kelly, Westinghouse Electric & Manufacturing Co.
Address (title to be announced)—Kinsey M. Robinson, Washington Water Power Co.
American Economic Problems If and When Peace Comes—Dr. Lionel Edie, consulting economist, New York, N. Y.
Adjournment.

Fourth General Session—Wednesday, 3 p.m.

Distribution Meets Its Responsibilities—H. P. Seelye, Detroit Edison Co.
"I Wouldn't Know About That"—James M. Stafford, Jr., Georgia Power Co.
The Rights of the Eye—Dr. Hugh Grant Rowell, Teachers College, Columbia University, New York, N. Y.
So Depreciation Is a Technical Problem!—C. E. Kohlhepp, Wisconsin Public Service Corp.
One-Way Street—Bernard S. Rodey, Jr., Consolidated Edison Co. of New York, Inc.
Adjournment.

Special Session—Wednesday, 9 p.m.

Musical Program—Karl Bonawitz, Organist; Miss Margaret Speaks, soprano; Benar Heifetz, solo cellist.
Let There Be Light—Howard Coonley, National Association of Manufacturers, New York, N. Y.
Adjournment.

Fifth General Session—Thursday, 9:30 a.m.

Announcement of Election of Officers.
1940 Rates—Drifting or Sailing—F. A. Newton, Commonwealth & Southern Corp.
Facts and Fallacies in Original Cost and Depreciation Accounting—Samuel Ferguson, Hartford Electric Light Co.
The "First Column" and Private Enterprise—Col. Robert S. Henry, Association of American Railroads, Washington, D. C.
Presentation of Charles A. Coffin Award.
Announcement of Prize Awards—H. P. Liversidge, Philadelphia Electric Co.
The Awards: Augustus D. Curtis Award, George A. Hughes Award, B. C. Forbes Prize, R. B. Marshall Award, Thomas W. Martin Award, James H. McGraw Prizes.
Adjournment.

Luncheon Meeting—Thursday, 1 p.m.

Hotel Traymore—American Room.
Luncheon.
Some of My Prejudices—Alex Dow, Detroit Edison Co.
Adjournment.

Three-Million-Dollar Expansion at Montaup

A $3,000,000 addition to the generating facilities of the steam plant of the Montaup Electric Co. at Somerset, Mass., is to be made by the Stone & Webster Engineering Corp., Boston, to bring the capacity of the station to approximately 100,000 kw. by the latter part of 1941. The enlargement can be financed from cash and accounts receivable in the company's hands requiring no issue of securities.

The new equipment will include a topping turbo-generator of about 20,000 kw. and a boiler of something over 600,000 lb. of steam capacity per hour. The operating steam pressure will be at least 1,675 lb. and the steam temperature about 950 deg. F. Either coal or oil can be burned. The turbine speed will be 3,600 r.p.m. and three-phase electrical energy will be generated at 14 kv. A small building addition will be required for the turbo unit. Contracts for turbo-generator and boiler will shortly be signed.

The Montaup company is a generating and transmission organization owned by the Brockton Edison, Blackstone Valley Gas & Electric and Fall River Electric Light companies. A 20 per cent increase in station economy is expected from the installation of the new boiler and topping turbine.

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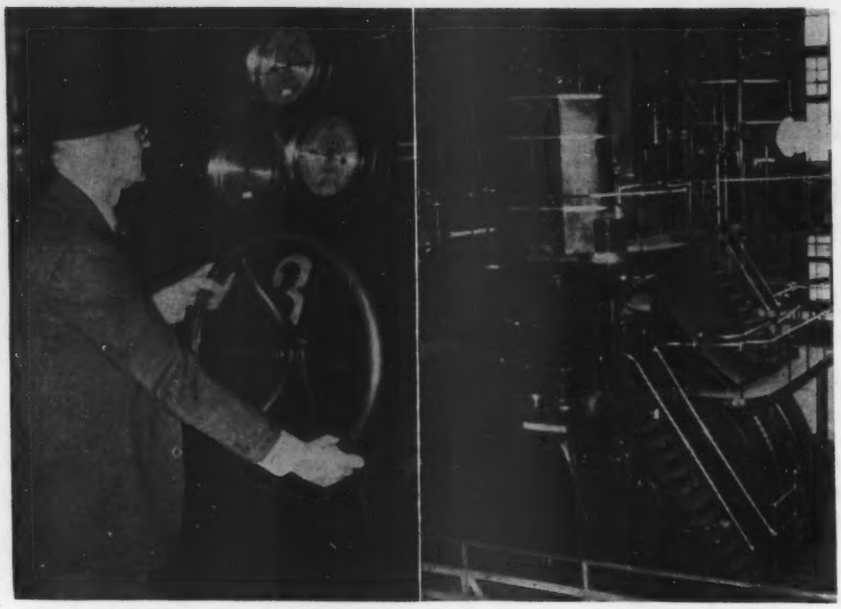
No Taxes from TVA, Says Military Subcommittee

Legislation to authorize the Tennessee Valley Authority to use part of its revenues to replace taxes which have been lost by local city and county governments in the TVA area will be tabled if the recommendations of a House military affairs subcommittee has its recommendations adopted.

The subcommittee has voted to recommend to its full committee that no portion of the revenues of the TVA be devoted to restoring to local authorities taxes which have been lost due to the replacement of private companies by TVA operations. Representative May of Kentucky, chairman of the subcommittee and chairman of the full committee, said that he expected to call the full committee into special session to act upon these recommendations before the week ended.



37 YEARS' SERVICE—Fred Dornbrook, chief engineer of power plants, Wisconsin Electric Power Company, as he prepared to shut down No. 3 engine at Commerce Street station. This veteran vertical double-expansion Corliss valve engine was the first unit to be started at Commerce Street when the station was new. It was started up by Mr. Dornbrook at 3 a.m. May 13, 1903, to meet an emergency and was still in regular operation when very recently it was shut down for dismantling to make room for the new 35,000-kw. unit soon to be installed at Commerce Street

Public Service Asks Exemption Under 3A2

With respect to the withdrawal by Public Service Corporation of New Jersey of its application filed with the Securities and Exchange Commission for exemption as a holding company, Wendell J. Wright, general counsel, has made the following statement to ELECTRICAL WORLD:

"Pursuant to the provisions of Section 3(a) of the Holding Company Act of 1935, Public Service Corporation of New Jersey, as well as its subsidiaries who were themselves holding companies, filed on November 28, 1935, applications for exemption. On November 29, 1935, the Securities and Exchange Commission promulgated Rule 3A2, which by its terms exempted all holding companies which are entitled to exemption within the language of Section 3(a) of the act. It will, therefore, be noted that Public Service Corporation of New Jersey was entitled to exemption by reason of having filed in good faith its formal application for exemption, and also by virtue of the provisions of the rule above referred to.

"The foregoing status continued until the above-mentioned rule was amended as of November 9, 1939. The amended rule added a requirement to the right of exemption to the effect that it should not apply unless the companies to which it was applicable should file not later than March 1, 1940, and annually thereafter, a statement on Form U3A2, and further provided that if it should appear to the commission from such statements or otherwise that a substantial question of law or fact exists as to the right of exemption, the commission should notify the holding company, and that the exemption would terminate after thirty days from the receipt of such notice without prejudice, however, to the right of the holding company to file a formal application for an order granting it exemption.

"Public Service Corporation of New Jersey, acting pursuant to the foregoing rule as amended, did file a statement prior to March 1, 1940, and thereafter the Securities and Exchange Commission raised the question that the company was claiming exemption under two different proceedings, *to wit*, one by formal application, and the other under the rule, and that it was of the opinion that the company should elect as between the formal application and the rule. Therefore, the corporation did elect to withdraw its formal application and retain its exempt status under the rule as amended."

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Votes to Acquire System

Huntsville, Ala., has voted to acquire the distribution system of the Alabama Power Co. in Madison County for $1,600,000. The city will negotiate a contract for the purchase of electric power from TVA.

Standard Gas Shows Substantial Growth

A program marked by open market acquisitions of debentures, approval of a $38,000,000 construction program for 1940, proposals to reduce debt ratios by distributing holdings of San Diego, California-Oregon and Mountain States subsidiaries and substantial gains in gross and net income are high spots of Standard Gas & Electric's annual report of 1939 operations.

Average residential usage of 998 kw.-hr. and average rate of 3.71 cents are, respectively, 10.8 per cent above and 8.6 per cent below national average, it is reported by President Bernard W. Lynch and Chairman Leo T. Crowley.

In a special statement, problems facing the company are outlined as follows: "The problems of the future include increasing the quantity and reliability of service to the public, compliance with the requirements of public regulatory authorities, continued co-operation with authorities administering public power projects in the territories served, refunding maturing obligations, refinancing to secure the benefit of prevailing low rates for money, providing funds for ever-increasing capital expenditures and the cultivation of good will and understanding in relations with the consuming public and with employees."

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Increased Lighting for New York Fair

While the lighting of the main exhibit of the New York World's Fair last year was generally considered to be entirely satisfactory, the illumination of the amusement area is to be increased ten times for this year and the zone's name changed correspondingly to "The Great White Way."

In the northern end of the area three 75-ft. steel towers, each carrying eighteen 1,000-watt lights, will floodlight the parachute jump, last year's major ride attraction. Between twenty and thirty "pinwheel" lights will be located around the Music Hall and its plaza. Each pinwheel light consists of two sets of eight lights that revolve in opposite directions. The sets are each mounted on a circular rack, with the upper rack of greater circumference. Lights are paired with one directed upward and the other downward; they are spaced at 90-deg. intervals.

Racks are mounted on 16-ft. metal poles. The cone-shaped reflectors inclosing the light directed upward are painted red, those pointing downward are painted blue and the poles are white. Each light uses a 300-watt bulb.

Human Relations Feature P.E.A. Operating Sessions

Problems of the new employee, popular quiz programs and self-audits for office, operating and meter reading employees mark crowded schedule at Johnstown meeting

Practical discussion of problems affecting the personnel of the electric industry and ways to improve day-by-day contacts with customers marked the program presented by 21 speakers at the operations section meeting of the Pennsylvania Electric Association, held April 24 at Fort Stanwix Hotel, Johnstown, Pa.

The program, which ran from 9 a.m. to round-table discussions terminating twelve hours later, stressed case history presentations of ways to break in new employees, and to check on employee performance, conferences on customer contact supervision and safety procedures.

Quiz Programs

The current vogue of quiz programs has been capitalized in Philadelphia Electric as groups of linemen, assembled for training, check "True" or "False" to statements like "When connecting a two-phase transformer installation to energized two-phase, five-wire secondary mains, it is not necessary to connect neutrals before phasing." Following a description of these non-collected, anonymous quizzes by L. E. Goodenough, supervisor of training, a second P.E. Co. speaker, M. S. Viteles, director of personnel research and training, outlined the company's "self-audit" plan for employees. Company drivers, shop personnel, garage mechanics, station operators and customer contact employees are presented with "self-audit" forms. They are not checked, collected or discussed, but are merely private tip-offs to the employee personally.

The sessions opened with the spotlight on the frequently overlooked needs of the new employee, with papers on the new district office clerk, the new meter reader and the new groundman. The extreme importance of the first experiences of the new employee with his new industry and new utility was stressed by Division Manager H. G. Wilhelm of Pennsylvania Electric Co. West Penn Power's District Manager J. V. Soisson described the selection and training of meter readers, with emphasis on keeping them posted.

"Here's How We Quit Irritating Our Customers" was a symposium at which Henry Flanagen described the superb Philadelphia Electric customer contact supervision procedure, W. E. Sturm of West Penn showed how it was possible to omit superfluities like residential contracts for service, delays in connecting new service and unnecessary requests for service deposits.

P. H. McCance, senior vice-president of Duquesne Light, principal speaker at the luncheon, surveyed human relations in the utility industry. H. K. Breckenridge of West Penn and chairman of P.E.A. operations section presided at the meetings.

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Woman Taxpayer Files Suit Against P.G.&E.

One of the after results of the decision by the Supreme Court of the United States invalidating the contract between the city of San Francisco and the Pacific Gas & Electric Co. concerning the distribution of water power from the Hetch-Hetchy project was the filing of a suit by Mrs. Henrietta Wright as a San Francisco taxpayer seeking returns from the city of the profit she claims P.G.&E. made during the fifteen years the contract was in operation. The taxpayer asks restitution of $75,000,000.

Secretary of Interior Ickes stated in Washington that he would allow the city of San Francisco some time to propose a new plan for the distribution of power from Hetch-Hetchy before he stepped in and suggested a distribution plan himself. This is a reversal of his previous statement a week ago in which he stated that while perhaps the city was saving $2,000,000 a year by its present arrangement with the Pacific Gas & Electric Co., it might save $4,000,000 a year through a municipal electric distribution system.

Meanwhile, in San Francisco, City Attorney John J. O'Toole has stated that four alternatives are open to the city with respect to the decision, one of which involves the discontinuance of the use of Hetch-Hetchy power.

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A. C. Laun Found Guilty

Albert G. Laun, formerly a vice-president of the Union Electric Co. of Missouri, has pleaded no contest in the U. S. District Court for the Eastern District of Missouri to three counts of perjury in testimony given before examiners of the SEC investigating business practices of the company. Federal Judge Charles B. Davis sentenced him to one year and a day on each count, the sentences to run concurrently, and fined him $1,500 on each count, or $4,500. A plea for suspension of the sentence was denied.

NEW RANGE ANNUALLY—Domestic science students at Traip Academy, Kittery, Me., enjoy cooking lessons on a battery of electric ranges aggregating 58 kw. in connected load. The Kittery Electric Light Co. and New Hampshire Gas & Electric Co., across the river in Portsmouth, have a standard practice of replacing one range yearly in each cooking school served with the latest model on the market, to insure students having up-to-date knowledge of available equipment

New Meter Devices Told at Meeting

Transition from a recent status of 80 per cent of meter purchases being small two-wire sizes to the present 75 per cent of buying in larger-capacity three-wire sizes was recorded by L. C. Blevins of Westinghouse at a recent meeting of the meter committee of the Pennsylvania Electric Association at Erie, Pa. Similarly 60 per cent of the demand meter production is in the cumulative register pattern and only 40 per cent in the sweephand style. Mr. Blevins suggested that meter engineers give more consideration to meters with more liberal tolerances of accuracy yet with economically sound characteristics.

Manufacturers presented information about forthcoming and recent metering devices as follows: Westinghouse, a single-phase ball-type kva. meter (late 1940), thermal demand meters for small reactive loads, chrome-steel non-corrosive ball for meter bearings, copper-plated damping magnets to thwart lightning demagnetization (60 to 90 days); Duncan, meter terminal block production now entirely porcelain, aging process for Alnico magnets fixed at 450 F. for eight hours (giving only 1 per cent magnet error at 212 F.); Eastern Specialty, new test jack for socket-meter testing, load analyzer giving ten-minute graphic of kw. and five minutes of kva.; General Electric, Alnico magnets at early date in limited quantities for new meters, terminal block flashover raised from 4.6 to 9.3 kv., demand-meter motor designed for five-year test interval; Sangamo, new type J meter with straight line accuracy to 400 per cent of rating, with improved torque and lower starting current; M. & W. Electric, lightning protectors for single- and polyphase-meters; Superior Switchboard & Devices, new primary transformer cabinet bushing of stud type.

E. L. Keller of Duquesne Light showed his thermal attachment for watt-hour meters to register kva. demand in the form now made by several manufacturers.

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Edison Advises on N.Y.C. Air-Conditioning Rules

Co-operating with the city in its efforts to conserve water usage through air-conditioning systems as part of a general campaign, Consolidated Edison's Sales Technical Bureau announces it will advise customers regarding proper size air-conditioning equipment and its relation to new regulations by the city.

These regulations now call for permits for all new installations of refrigeration or air conditioning. Water supply must be metered when minimum rate of water required for operation exceeds ½ gal. per minute. Waste water cannot exceed 5 gal. per minute. Systems using city water in excess of this rate must be equipped with economizer, evaporative condenser, cooling tower or other similar conservation equipment.

MEETINGS

Edison Electric Institute—Technical committees, Edgewater Beach Hotel, Chicago, Ill., May 6-9; annual convention, Atlantic City, N. J., June 3-6.

Refrigerating Machinery Association — Annual meeting, The Homestead, Hot Springs, Va., May 9-10.

Southeastern Electric Exchange — Annual conference, Hotel Roanoke, Roanoke, Va., May 9-11. J. W. Talley, executive secretary, 308 Haas-Howell Bldg., Atlanta, Ga.

National Fire Protection Association — Annual meeting, Atlantic City, N. J., May 6-11. Robert S. Moulton, technical secretary, 60 Batterymarch St., Boston, Mass.

Air Conditioning Manufacturers' Association — Annual meeting, The Homestead, Hot Springs, Va., May 11. William B. Henderson, executive vice-president, Southern Building, Washington, D. C.

National Electrical Manufacturers Association — Spring meeting, The Homestead, Hot Springs, Va., May 12-17. W. J. Donald, managing director, 155 East 44th St., New York.

National District Heating Association — Annual meeting, French Lick Springs Hotel, French Lick, Ind., May 14-17. John F. Collins, Jr., secretary-treasurer, 1231 Grant Building, Pittsburgh, Pa.

Empire State Gas and Electric Association—Electric operating group, New York, N. Y., May 17. George H. Smith, secretary, Grand Central Terminal, New York, N. Y.

South Dakota Central Station Conference—Annual meeting, sponsored by the North Central Electric Association, Sioux Falls, S. D., May 19-20. W. E. Olson, secretary-manager, North Central Electric Association, 803 Plymouth Bldg., Minneapolis, Minn.

National Electrical Wholesalers Association—Annual convention, The Homestead, Hot Springs, Va., May 19-23. E. Donald Tolles, managing director, 165 Broadway, New York, N. Y.

Pacific Coast Electrical Association—Annual convention, Hotel Oakland, Oakland, Calif., May 22-24. Harold O. Noack, Hubbard & Co., Oakland, convention chairman.

Northwest Electric Light and Power Association—Accounting and business practice section, Benson Hotel, Portland, Ore., May 23-24. Berkeley Snow, executive secretary, 707 Spalding Bldg., Portland, Ore.

National Association of Purchasing Agents—Annual convention, Netherland Plaza Hotel, Cincinnati Ohio, June 3-6. G. A. Renard, executive secretary-treasurer, 11 Park Place, New York, N. Y.

American Society of Mechanical Engineers — Semi-annual meeting, Milwaukee, Wis., June 17-21. C. E. Davies, national secretary, 29 West 39th St., New York, N. Y.

Public Utilities Advertising Association — Annual convention, Palmer House, Chicago, Ill., June 23-24. H. W. Olcott, Bozell & Jacobs, Indianapolis, Ind., secretary.

American Society for Testing Materials—Annual meeting Chalfonte-Haddon Hall, Atlantic City, N. J., June 24-28. R. E. Hess, assistant secretary, 260 South Broad St., Philadelphia, Pa.

American Institute of Electrical Engineers—Summer convention, Swampscott, Mass., June 24-28. H. H. Henline, national secretary, 33 West 39th St., New York.

Society for the Promotion of Engineering Education—Annual meeting, University of California, Berkeley, Calif., June 24-28.

Canadian Electrical Association — Fifieth annual convention (Golden Jubilee), Seigniory, Club, P. Q., Canada, June 25-28. B. C. Fairchild, secretary, 804 Tramways Bldg., Montreal, Canada.

New Deal Theories Failure, Says Willkie

The political party currently in power has been trying for eight years to prove the value of its theories and has failed, Commonwealth & Southern's Wendell L. Willkie told members of the American Newspaper Publishers Association in convention assembled in New York last week.

"One-third of the nation is still in need," Mr. Willkie reminded his hearers. "Ten million men are still unemployed. The deficit continues to increase. The people, I hope, are now ready to try again the other theory—to release the enterprises of the people from the terrific weight of bureaucracy and to rededicate the government to the purpose of leaving men free."

Not all the liberals are resident in Washington, Mr. Willkie pointed out, stating that "the liberal is a man who believes in freedom for himself and for other people."

To the true liberal, he said, the purpose of government is unchangeable and it is to leave to free men their freedom. In the present huge federal machine of more than a million political employees, with prodigious expenditures of billions, there is no will to leave Americans their freedom, said Mr. Willkie, but instead the notion is prevalent that this government should exercise a dominant force over the lives of people.

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SEC Exempts 40 From Integration Order

Reversing its original order against the United Gas Improvement Co., holding that 40 companies were subsidiaries of the company, the Securities and Exchange Commission has granted the request of these companies that they be exempted from proceedings.

The principal companies granted exemption by this order are Midland United Co., Midland Utilities Co., Gary Indiana Electric & Gas Co., Northern Indiana Power Co., Public Service Co. of Indiana, Dresser Power Corp., Northern Indiana Public Service Co., Central Indiana Power Co., Gary Heat, Light & Water Co., Terre Haute Electric Co., and West Indiana Utilities Co.

The SEC said is appeared unlikely that the commission will find it necessary to require the 40 companies named to take any action under the integration section of the public utility act of 1935. Nevertheless, the SEC has reserved the right to issue future orders directing the U.G.I. to dispose of its "direct or indirect security holdings" in these 40 companies if SEC decided that such orders are necessary.

Electricity Output Dips 1% During Week

Production of electricity by the electric light and power industry in the United States during the week ended April 27 was 2,397,626,000 kw.-hr., a dip of about 1 per cent from the previous week, according to the Edison Electric Institute. While it was seasonal, this dip compared with a decrease of 0.7 per cent last year, one of 0.6 per cent in 1938 and an increase of 0.3 per cent in 1937.

Output for the week ended April 27 was 9.8 per cent above 1939, 23.7 per cent ahead of 1938 and 9.3 per cent—smallest margin so far this year—in advance of the previous high output year, 1937. With respect to the winter peak, the most recent output figure was 9.2 per cent below the 1939 peak; corresponding decreases for 1939, 1938 and 1937 were 7.6, 11.9 and 3.7 per cent, respectively.

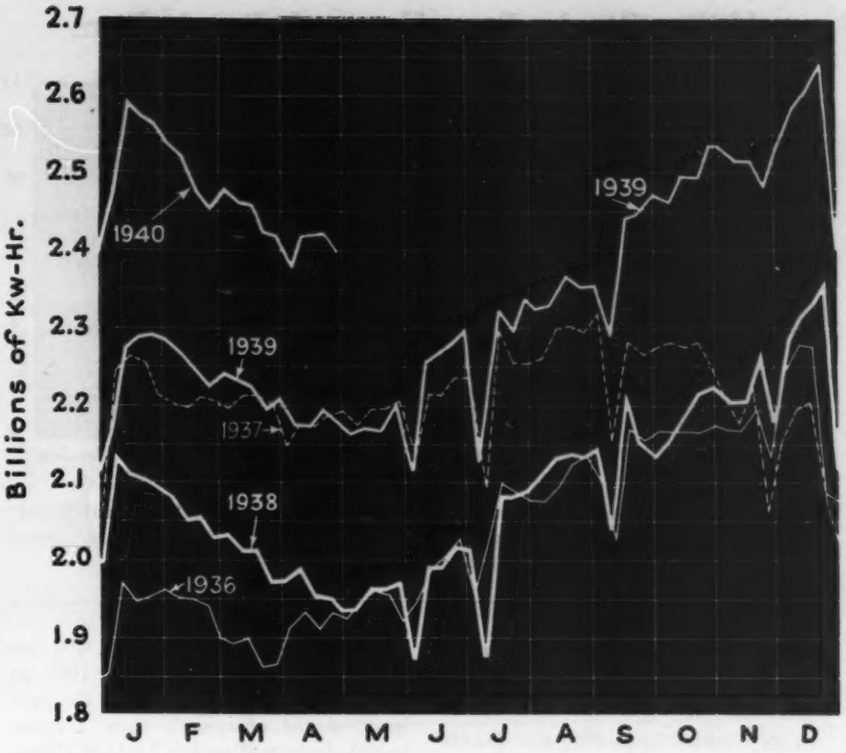
With an increase of 14.4 per cent for 1940 over 1939 in the week of April 27, the Central Industrial region gained first position; the West Central and Pacific Coast states also showed improvement over the preceding week, while the remaining regions lost ground.

Weekly Output Millions Kw.-Hr.

1940		1939		1937	
Apr. 27	2,398	Apr. 29	2,183	May 1	2,194
Apr. 20	2,422	Apr. 22	2,199	Apr. 24	2,188
Apr. 13	2,418	Apr. 15	2,171	Apr. 17	2,173
Apr. 6	2,381	Apr. 8	2,174	Apr. 10	2,176
Mar. 30	2,422	Apr. 1	2,210	Apr. 3	2,147
Mar. 23	2,424	Mar. 25	2,199	Mar. 27	2,200

Per Cent Change from Previous Year

	Week Ending		
	Apr. 27	Apr. 20	Apr. 13
New England	+ 5.0	+ 8.2	+ 6.4
Middle Atlantic	+ 6.0	+ 8.6	+10.4
Central Industrial	+14.4	+12.9	+14.5
West Central	+ 8.2	+ 7.5	+ 8.0
Southern States	+12.3	+12.7	+12.8
Rocky Mountain	+13.6	+14.4	+14.2
Pacific	+ 1.3	+ 0.7	+ 2.0
United States	+ 9.8	+10.1	+11.4



Boulder Dam Rates Revised in New Bill

A new bill to revise the financial arrangements for the sale of power from Boulder Dam has been introduced by Representative James G. Scrugham of Nevada. A similar bill was introduced last year, but it was withdrawn because the interested parties failed to reach an agreement.

As introduced, the bill gives something to everybody (except the Treasury). Los Angeles and the other power users get lower rates for power. The lower basin states, Arizona and Nevada, each get $900,000 right away and $300,000 a year from then on, though losing the future possibility of a larger sum.

The upper basin states get $500,000 a year for the Colorado River development fund, again at the sacrifice of larger sums in the future. The government gets closer control over the generating plant, now operated under lease by the power users.

Power rates at present are set to conform to rates prevailing in the load centers. It is proposed that power rates be set at a level which will cover operation and maintenance, payment of $600,000 to the downstream states and $500,000 to the development fund, and amortization. The interest rate would be set at 3 per cent.

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Canadian Output Rises

Output of central electric stations in Canada during March totaled 2,426,157,000 kw.-hr., compared with 2,367,031,000 kw.-hr. in February and 2,366,740,000 kw.-hr. in March, 1939, the Dominion Bureau of Statistics reports. Exports to the United States amounted to 155,402,000 kw.-hr., against 139,908,000 kw.-hr. in the previous month and 165,422,000 kw.-hr. in March, 1939.

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Hydro to Use Surplus

London district of the Ontario Municipal Electrical Association has approved a motion giving the Ontario Hydro-Electric Power Commission use of municipal power surpluses during the war. Approval came after Dr. Thomas Hogg, chairman of the Ontario commission, said that the war tripled the budget for hydro construction and made power increase "a serious thing."

Gatineau Power Output Continues Rise in 1940

Because of increased activity of heavy industries and wider use by residential consumers the 1939 increase in output of electric energy by the Gatineau Power Co., Ltd., has continued into 1940, G. Gordon Gale, president, told shareholders at the recent annual meeting in Montreal.

In reviewing last year's operations Mr. Gale said that the position of the company had been improved substantially as a result of the refunding of its first mortgage bonds.

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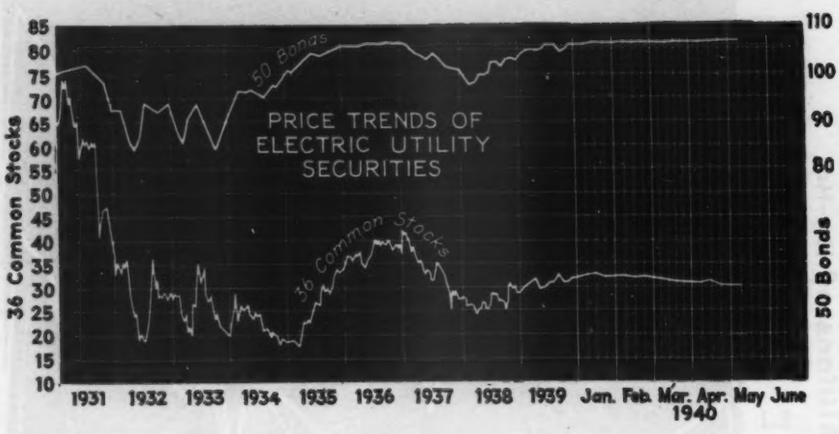
Seek to Complete Deal

Pennsylvania Water & Power Co., Holtwood, Pa., and the Consolidated Gas, Electric Light & Power Co. of Baltimore have applied to the Federal Power Commission for authority to acquire additional stock of the Safe Harbor Water Power Corp. The stock would be the last quotas of the companies which jointly own Safe Harbor Water Power, which owns and operates a hydro-electric generating plant at Safe Harbor on the Susquehanna River in Pennsylvania.

Utility Stocks Turn Upward; Bonds Firm



Electric light and power stocks advanced during the past week, the "Electrical World" index moving up to 31.5, compared with 31.1 last week and 28.8 last year. Bonds held firm, the "Electrical World" index remaining unchanged at 106.2

Toledo Payment from Surplus, SEC Claims

In its decision approving the Toledo Edison Company's recent bond and debenture issue the Securities and Exchange Commission criticised the dividend policy of the company, stating that between September 30, 1934, and December 31, 1939, common stock dividends exceeded earnings available by $1,800,000.

"The effect of this dividend policy has been twofold," the SEC stated. "First, the ratio of common stock and surplus to total capitalization has been reduced. Secondly, such policy has placed the applicant in the position that now, when faced with the imperative needs of funds for new construction, its only source of such funds is through increasing its debts."

As a result, the SEC alleges it is requiring that $362,500 of such earnings available for common stock be added to the surplus annually, as long as any of the new debentures are outstanding.

The order was published a week before the SEC released the full text of its decision discussing the order.

•

Registers $1,000,000 Bond Issue with SEC

West Coast Power Co. has filed an application with the SEC regarding the issuance and private sale of $1,000,000 of first mortgage 4¼ per cent bonds, series A, due 1965, to five insurance companies. Proceeds from the sale are to be applied as follows:

(a) To the redemption of $725,000 principal amount of the company's outstanding first mortgage bonds, 4½ per cent, series A, due January 1, 1961, at 100 per cent, $725,000; (b) to the payment of the company's open account indebtedness to People's Light & Power Co., $106,000; (c) to reimburse the company for the cost of constructing additions and improvements to its property subsequent to January 1, 1940, and to reimburse it for expenses, estimated at not more than $25,000 in connection with the proposed transaction, $169,000.

•

Files Stock-Note Issue

Otter Tail Power Co., Fergus Falls, Minn., has filed application with the FPC for authority to issue not to exceed 13,346 of its $4.50 dividend preferred shares and to issue its unsecured note to the First National Bank of Minneapolis in an amount of not to exceed $900,000 in connection with its proposed call for redemption on July 1, 1940, of all outstanding $5.50 dividend preferred shares.

•

Utility Gets Approval for Refinancing Bonds

Permission for the Jersey Central Power & Light Co. to refinance $42,225,000 of bonds by selling securities at lower interest rates has been granted by the state Board of Public Utility Commissioners. Action by the company on the board's approval is based on approval by the SEC.

The company would issue $38,000,000 of bonds due in 1965 at 3½ per cent annual interest and $5,300,000 in ten-year serial notes at 3⅛ per cent. Proceeds would be used for refunding.

Gross Drop Regained by California Edison

The 1930–39 decade was one of the most difficult in American history and saw vast changes in utility operations, Harry J. Bauer, president of Southern California Edison Co., Ltd., told stockholders in the annual report.

Mr. Bauer pointed out that gross in 1930 was $41,128,723, fell to $35,251,630 in 1933 and has gradually been built back to $46,246,573 in 1939. This recovery in gross, he says, has taken place despite the loss of $3,700,000 in wholesale business due to Boulder Dam power and rate reductions totaling more than $5,000,000 annually.

Taxes, which were $4,149,929 in 1930, have risen to $7,936,956 in 1939. Depreciation charges were $5,014,460 in 1930 and $7,554,687 in 1939. Net income was $12,701,916, equivalent after preferred dividends to $2.39 a common share in 1939, against $11,733,479, or $2.10 a common share, in 1938.

The report showed the average annual residential consumption of 978 kw.-hr. in 1939, against 682 in 1934. Agricultural power sales produced $5,128,477, at an average cost of 1.27 cents a kw.-hr.

During 1939 the load building program produced sales of 6,167 ranges and water heaters, 35,893 refrigerators, 27,093 washing machines, 3,377 ironers, 58,279 radios and 87,402 miscellaneous electric appliances. At the end of 1939 the company was serving 544,762 meters with a connected load of 2,996,184 hp., against 558,840 meters and 2,857,198 hp. in 1938.

New construction for 1940 totals $4,242,578, of which $253,588 is for production plants, $46,806 transmission lines, $2,671,426 distribution lines, $842,265 substations and $428,493 general expenditures.

Mr. Bauer said that prospects for 1940 in the territory appear to be favorable.

Utility Reports

	Net Income 1940	1939
*Commonwealth & Southern and subs.	$13,699,733	$11,591,474
*Philadelphia Electric System	22,760,776	21,911,256
†Carolina Power & Light	2,367,840	2,499,312
†Gulf States Utilities	2,760,896	2,142,989
†Houston Lighting & Power	2,746,863	3,010,041
†Montana Power and subs.	3,454,208	2,692,837
†Nebraska Power	1,735,449	1,867,840
†New Orleans Public Service	2,346,532	1,637,396
†Puget Sound Power & Light and subs.	2,139,666	1,609,868
†Idaho Power	1,515,296	1,701,430
†Texas Power & Light	2,238,234	1,968,951
‡Washington Water Power and sub.	3,079,985	2,530,805

*Twelve months ended March 31.
†Twelve months ended February 29.
‡Twelve months ended January 31.

Type JW-6
5000 volts

You Get Top-Grade Metering Accuracy with This NEW Outdoor Current Transformer

HIGH accuracy all the way down to five per cent of the rating—that's one of the important features of this new metering transformer. And its excellent performance in this respect is clearly illustrated by the curves at the right. Just study for a moment what excellent accuracy Type JW-6 provides. Then consider what this means to you in terms of better metering—assurance of transformer accuracy that meets the highest specifications: ¼X, ¼Y, ¼Z.

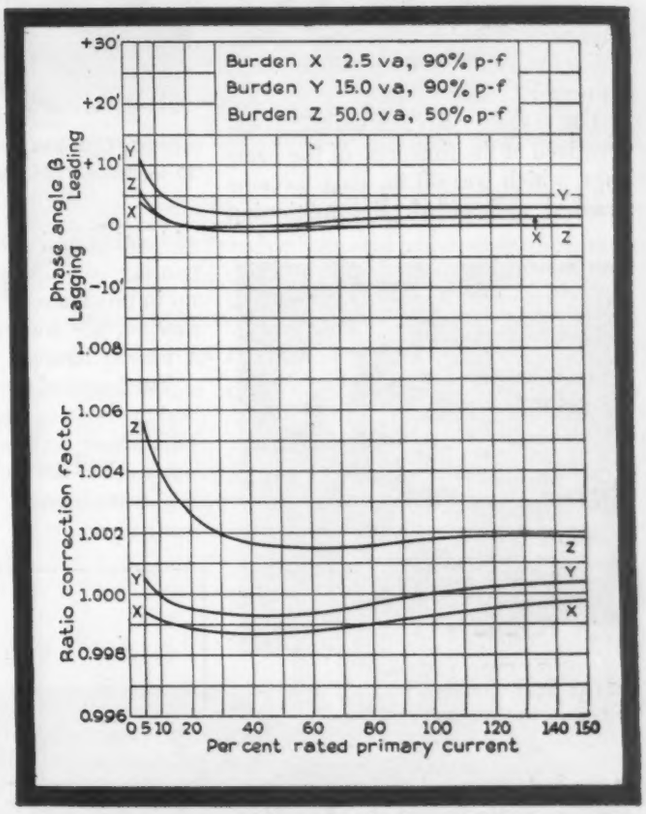
AND BETTER INSULATION

Along with the high accuracy, Type JW-6 offers the advantages of insulation that is designed to withstand a 60-kv full-wave impulse test (2.2-inch test gap). This means that when you use these transformers, you're lining up your apparatus to meet the standard specifications set up by the ASA for insulation for this class of service.

OTHER ADVANTAGES

Besides high accuracy and excellent insulation, Type JW-6 offers the added advantages of a welded-steel tank with mounting brackets welded to the case. Flexible leads, and secondary bushings that can be replaced by conduit connections, increase the ease of installation.

For a complete description of the new Type JW-6, call the nearest G-E office or write for Bulletin GEA-3357. General Electric, Schenectady, N. Y.



Ratio- and phase-angle characteristics

The outstanding accuracy of Type JW-6—particularly at the lower values—is obtained by means of the Wilson compensation scheme, an exclusive G-E feature

GENERAL ELECTRIC

OPERATING PRACTICES

Rebabbitt Bearing by Welding in Field

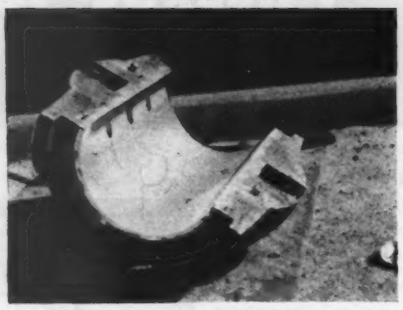
Several years' operation attest the success of a scheme for reconditioning a turbine bearing which was devised at Southern Colorado Power Company. The machine involved is a 7,500-kw. unit, with a 15-in. shaft turning at 1,800 r.p.m.

For some reason not definitely determined at the time, one of the bearings, which was 30 in. long, became cracked and pitted. Reconditioning

METAL built up with ordinary welding torch

at the factory would at that time have cost, including freight charges, about $1,400. Hence it was decided to attempt repair on the job.

Pitting and oil pockets were chiseled out clean and the metal was built up by welding with an ordinary No. 15 acetylene torch. High-speed, high-grade babbitt was used for the purpose, made into welding rods by pouring in molds. It was found to flow and fuse perfectly with the old metal, and by thus confining the heat, the process eliminated the possibility of heating and damaging the bearing cooling coils. After it had been built up in this manner with new metal, the new surface was then machined with a boring bar.



COMPLETED JOB—the bearing is 30 in. long; 15-in. shaft

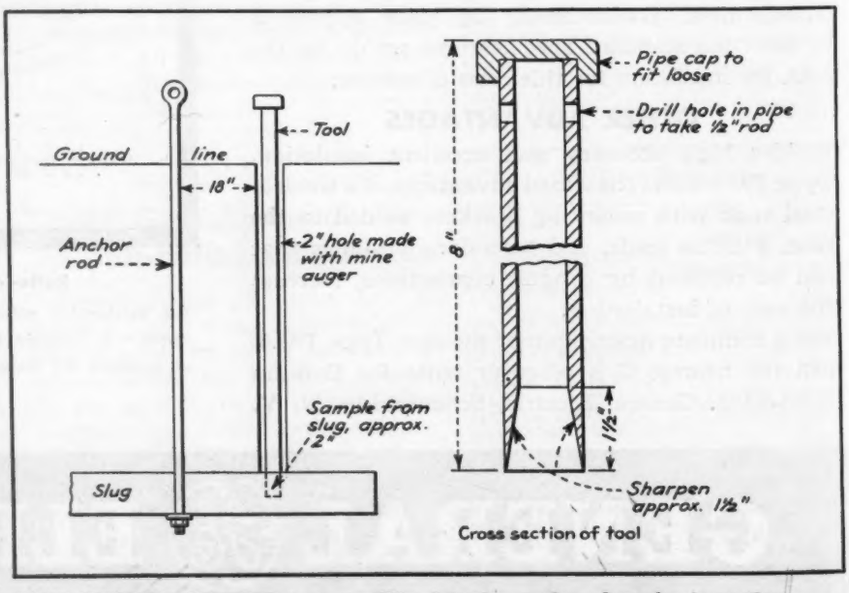
Total cost of the job was about $75 and the bearing has given continuous, satisfactory service since. The method was worked out by George W. Devine, assistant master mechanic of the company.

Tool Aids Testing of Anchor Slugs

A tool developed by R. L. Winn, high line foreman of the Alabama Power Company, which removes a 2-in. sample from a possibly defective slug anchor is proving a valuable maintenance aid, according to *Powergrams*, since it obviates the necessity for digging to the slug and inspecting it.

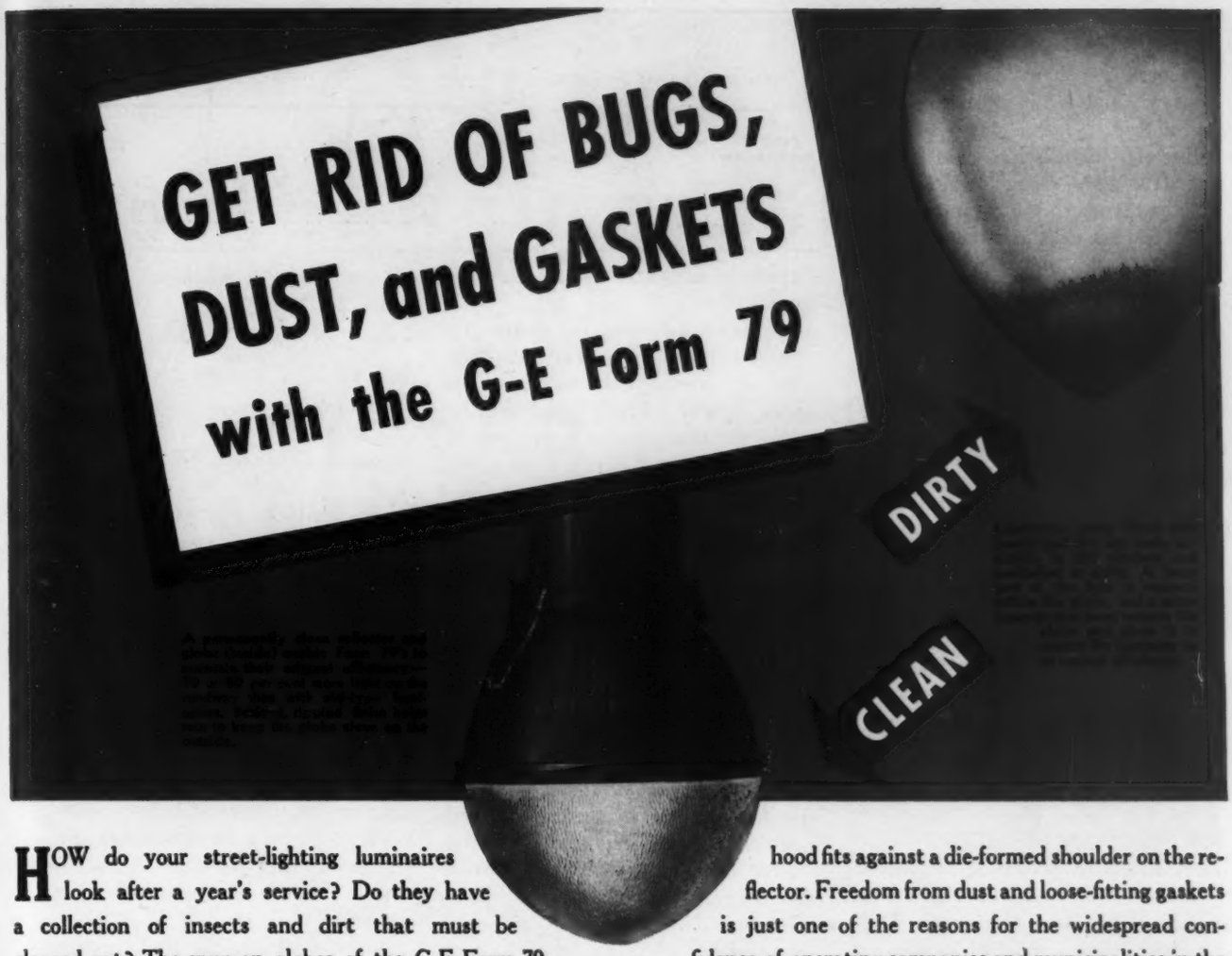
The tool is made from an approximate 8-ft. section of 1-in. extra heavy pipe. One end is sharpened on the inside for about 1½ in. A hole is drilled through the pipe, near the top end, to take a ½-in. rod which is used to twist the pipe in removing it from the slug after the sample has been obtained. A pipe cap is loosely fitted over the top end of the tool to prevent "mushrooming" of the pipe when it is struck with a hammer.

In using the tool the slope of the

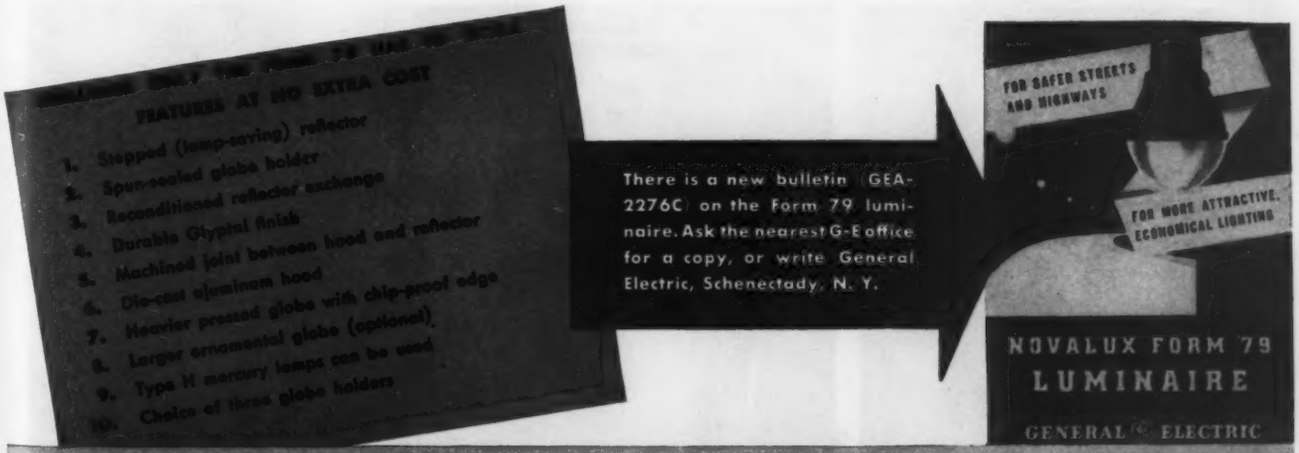


TOOL REMOVES SAMPLES from possibly defective anchor slugs for inspection

GET RID OF BUGS, DUST, and GASKETS with the G-E Form 79



HOW do your street-lighting luminaires look after a year's service? Do they have a collection of insects and dirt that must be cleaned out? The spun-on globes of the G-E Form 79 dust-tight luminaires prevent this unsightly condition and eliminate this expense. ● Form 79 reflectors inspected after years of service have been found absolutely clean. The joint that is opened for relamping the unit can be kept tight, not by the use of gaskets, but because an accurately die-cast aluminum hood fits against a die-formed shoulder on the reflector. Freedom from dust and loose-fitting gaskets is just one of the reasons for the widespread confidence of operating companies and municipalities in the spun-on globe—an exclusive feature of Novalux Form 79 luminaires. ● You can gain the advantage of lower cleaning expense—plus higher efficiency and lower maintenance—by using Form 79 luminaires. Just call the nearest G-E office, or write General Electric, Schenectady, N. Y.


FEATURES AT NO EXTRA COST
1. Stepped (lamp-saving) reflector
2. Spun-sealed globe holder
3. Reconditioned reflector exchange
4. Durable Glyptal finish
5. Machined joint between hood and reflector
6. Die-cast aluminum hood
7. Heavier pressed globe with chip-proof edge
8. Larger ornamental globe (optional)
9. Type H mercury lamps can be used
10. Choice of three globe holders
There is a new bulletin (GEA-2276C) on the Form 79 luminaire. Ask the nearest G-E office for a copy, or write General Electric, Schenectady, N. Y.
FOR SAFER STREETS AND HIGHWAYS
FOR MORE ATTRACTIVE, ECONOMICAL LIGHTING
NOVALUX FORM 79
LUMINAIRE
GENERAL ELECTRIC

GENERAL ELECTRIC

452-2

anchor rod is determined by digging around the rod and a hole is drilled to the slug with a 2-in. mine auger, approximately 18 in. from the anchor rod and at the same slope. The tool is inserted in this hole and the pipe cap struck with a sledgehammer sufficiently to secure the sample—2 or 3 in. thick—from the slug. Twisting the tool lightly until it is loose permits removal from the slug and the sample can be removed with a piece of wire.

Fifty or sixty slugs have been tested in this manner and a number have been checked by digging up the slug. In each case the slug was found to be in the condition indicated by the sample.

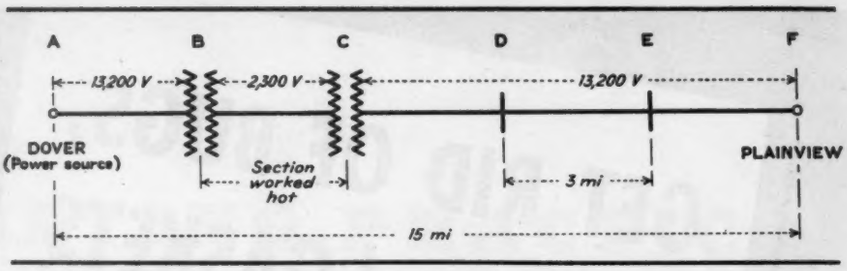
•

Stokers Steam-Driven in Emergencies

To provide for continuous service of its boilers in case of temporary interruption of electrical supply or other trouble involving stoker units at the generating plant of the Haverhill (Mass.) Electric Company auxiliary drives from vertical steam engines were installed after the 1936 flood on the Merrimac River. These can be placed in operation in about five minutes if needed. The driving arrangement provided for three boilers illustrates the method adopted.

In the basement below the operating floor of the boiler room the company set up a 6x6-in. Sturtevant engine, normally run at 150 r.p.m., and connected this by chain and sprocket drive to a run of 2¼-in. shafting turning normally at the same speed. From this shafting three sprocket chains were run inside metal guards to the floor above, where connection is made through an adjustable sliding clutch to an extension of the main stoker drive shaft 14 in. long, which was electrically welded to the original shafting.

Each boiler is equipped with a set of seven-retort Taylor underfeed stokers driven through planetary gearing by a 7.5-hp., four-speed, 550-volt Louis Allis induction motor. The stokers are designed for two-speed operation by hand lever adjustment of the planetary gearing, so that the four motor speeds available increase the number of speeds to eight. The auxiliary engine was designed for operation at 450 r.p.m. maximum, so that a smooth range of speed can be had to meet operating conditions by throttling the steam supply at the cylinder. Normal speed of the main drive shaft is 137 r.p.m., with a range of 70 r.p.m. above and below.



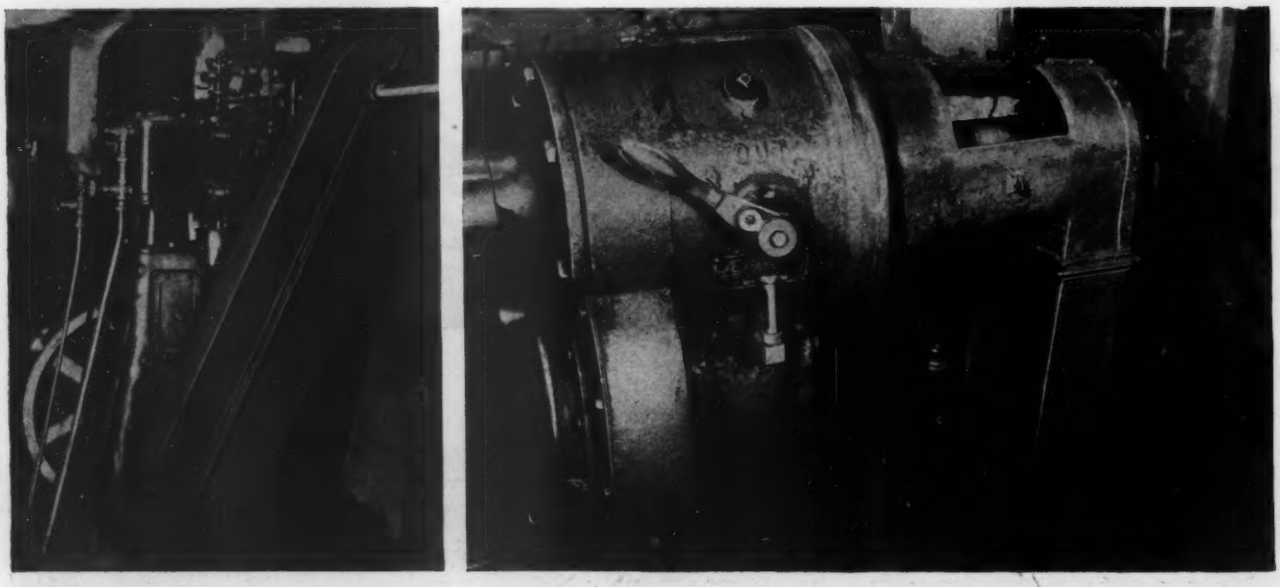
TRANSFORMERS STEP 13.2-kv. line voltage down to 2.3 kv. for maintenance

Step Voltage Down to Work Line Hot

Faced with the problem of rebuilding a 15-mile, 13,200-volt spur line between Dover and Plainville, Minn., without interrupting service C. E. Meyers, district manager of the Interstate Power Company, suggested stepping the voltage down to 2,300 and working the 2,300-volt section of the line "hot."

As shown in the accompanying diagram, a set of 13,200/2,300-volt step-down transformers was temporarily installed at B, reducing voltage to 2,300. At C, 3 miles along the line, another set of 2,300/13,200-volt step-up transformers was installed, bringing the voltage back to 13,200. The 3-mile stretch energized at 2,300 volts was then worked "hot."

When work was finished on stretch B-C this section was cut back to 13,200 volts, the transformers removed and stretch C-D treated in like manner. This was done to five 3-mile sections, the *Interstate Power News* reports, until the entire 15 miles of the line was completely rebuilt.



ENGINE-DRIVEN MAIN SHAFTING serves three boilers in stoker drive (left). Close-up of stoker drive shaft extension showing adjustable clutch and housed-in chain drive for emergencies (right)

WHY HIGH TORQUE?

IN ITS simplest terms, the case for high torque in watthour meters is this: the higher the torque, the smaller the effects of friction increase; and the smaller the increase, the greater the sustained light-load accuracy.

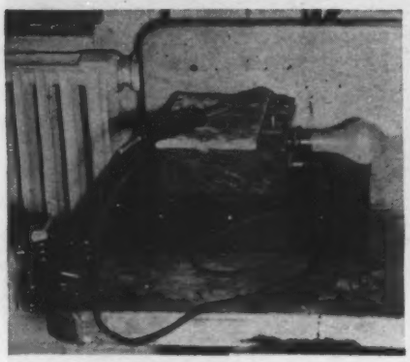
And yet the value of high torque is greatly diminished if it is obtained with large energy losses, or by sacrificing such desirable electrical characteristics as a light moving element, low value of useful current flux, and low speed.

Because proper consideration has been given to the relative importance of the factors that influence meter performance, General Electric's I-30 meters offer the advantages of high torque without penalty. Sustained light-load accuracy, low speed, and low useful current flux—all these are features of the I-30 line.

GENERAL ELECTRIC

601-2

Keeps Soldering Iron Warm



To perform the homely job of keeping an electric soldering iron warm while it is not in use, so that they wouldn't have to wait quite so long for it to heat up when needed, some of the men in the electrical laboratory of the Consumers Power Company conceived the idea of putting a lamp in series with it. A by-pass switch short circuits the lamp when the iron is needed. A lamp of the same wattage as the iron works best. An old instrument case makes a handy rest for the iron and a good mounting place for the lamp and switches.

•

Washing Turbine Improves Performance

Washing of the 50,000-kw. Westinghouse superposed turbine at Schuylkill station of Philadelphia Electric Company when the impulse stage pressure increased because of fouling resulted in restoring this pressure and the steam rate to the clean turbine condition.

Internal inspection at the time of a shut-down for dismantling early last year disclosed a heavy chemical deposit on the last six stages of the turbine. As a consequence, provision was made for washing the unit later. The equipment consists of a group of spray nozzles installed in the steam header about 75 ft. upstream from the turbine throttle. The capacity of the nozzles was selected so that, when supplied with boiler feed water at boiler feed pressure, they would admit sufficient water to desuperheat completely about 300,000 lb. of steam per hour.

In operation, it was proposed to reduce gradually the temperature of the high-pressure steam at this point to about 10 deg. superheat, and, with the control valves of the turbine open, to hold the load on the unit at about 1,000 kw. by adjustment of the turbine throttle. In this manner the pressure of the steam would be reduced, through the throttle, from 1,250 lb. to about 400 lb. with the result that the steam on leaving the throttle would be somewhat more than 1 per cent wet. The work done by the turbine would further reduce the heat in the steam and increase its moisture content. In this manner the steam condition ahead of the throttle could always be kept under control and it was felt that the steam within the turbine would be sufficiently wet for washing.

After the turbine was returned to service daily observations were made of the impulse stage pressure with relation to load. By early October this pressure had increased to such an extent that it was decided the turbine would be washed. The unit was therefore taken out of service on the 15th and washed in the above manner. Chemical checks on the turbine exhaust indicated that washing began about ten minutes after conditions were set and continued for about five hours. At the end of this time the water was gradually turned off the nozzles over a period of about two hours and the turbine warmed up and returned to normal service.

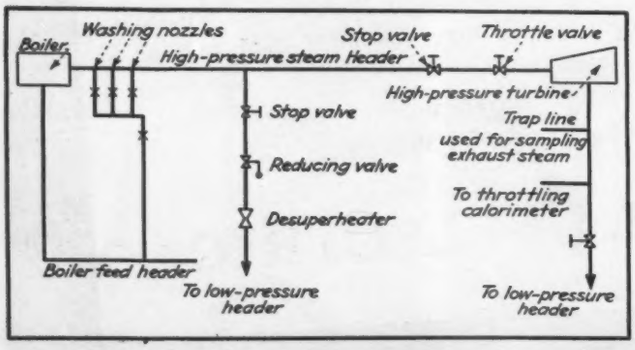
Subsequent checks of the impulse pressure indicated that conditions had been returned to normal and steam rate tests indicated a substantial improvement in economy. A check of the steam rate before and after washing showed that the steam rate was improved about 1 per cent and also that the point of opening of the impulse stage by-pass or overload valve was moved to the right approximately 1,000 kw.

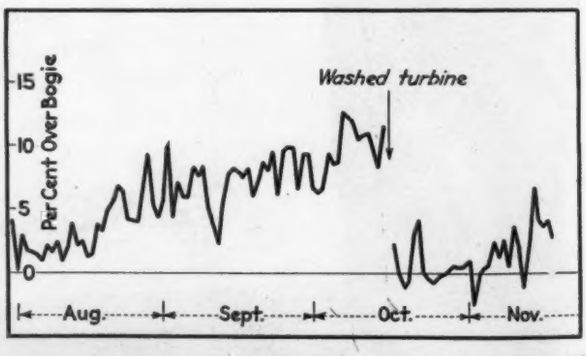
•

Substation Equipment Costs

The more important items involved in two recently completed substation work orders of an Eastern power company are given below for use in estimating. The original field sheets contained a large number of diversified items, many of which totaled but a few dollars each, and these are included in miscellaneous costs to save space in the tabulation:

1. Installation of three 500-kva., 13.2-kv. to 4,600-volt, 60-cycle oil-immersed transformers:	
Transformers	$5,203.04
One 15-kv. oxide film lighting arrester	468.00
Labor and supervision	778.96
Wire fencing	127.75
Miscellaneous	1,691.81
Total	$8,269.56
2. Installation of a 20-kw. constant current transformer: time three days	
C.C. transformer	$300.00
Labor	18.08
Truck service	2.70
Mileage	2.40
Total	$323.18





WASHING SUPERPOSED TURBINE improves steam rate and decreases impulse stage pressure—Washing equipment (left) consists of group of spray nozzles installed in the steam header about 75 ft. upstream from turbine throttle. Graph (right) shows change in impulse pressure as a result of washing

What an Improvement!

When Modern Unit Substations Replace the Old, Conventional Structures

BEFORE

Here's the old outdoor substation (supplying power to a suburban section in Louisville) just before it was dismantled. The new unit substation has already been set in place, and the top of the transformer is just visible behind the old structure

Watch a G-E Unit Substation Improve Appearance, Cut Space Requirements, Increase Capacity

AFTER

Now the old station has been removed, and the G-E unit substation—neat, compact, attractive—has taken over the job. Rating of the new station is 2000 kva, which is twice the capacity of the old station. (The brick house in the rear is not part of the electric substation)

THE trend is to modern, factory-assembled unit substations—for economy, flexibility, and attractive appearance. The Louisville Gas & Electric Company, for example, has a policy of replacing existing conventional substations with unit substations whenever load growth makes it necessary to increase substation capacity in residential or suburban areas.

And no wonder! With unit substations, expensive new construction is avoided. Their compact design makes possible the installation of additional capacity without an increase in the real-estate investment. The greatly superior appearance of the new stations builds customer good will. If future system growth makes it desirable to relocate the substation, it can be moved readily to a new location.

Find out for yourself how G-E unit substations can simplify system planning and cut costs for you. Write today for our new brochure GEA-2996, which contains the complete story. In addition to both single-circuit and multiple-circuit unit substations for permanent installation, it describes the new G-E portable unit substations for temporary installation or for emergency use. Address General Electric, Schenectady, N. Y.

GENERAL ELECTRIC

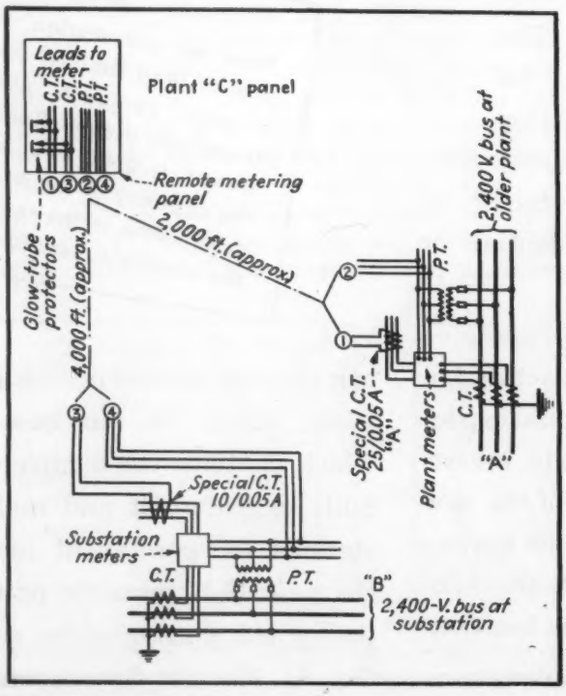
INDUSTRIAL ENGINEERING

Centralized Metering for Industrial Plant

In connection with an industrial plant development program completed some time since it became desirable to centralize the readings of energy intake from buses located at three points "A," "B" and "C" at a switchboard situated at "C." Point "A" is an older generating plant belonging to the factory, point "B" is a substation where purchased energy is received and point "C" is a later generating plant on the mill property. At all of these points the main buses are 2,400-volt, three-phase set-ups. The older plant "A" is about 2,000 ft. and the substation about 4,000 ft. from the plant "C," where the centralized metering panel was provided.

Connections with the centralized metering panel are provided by aerial cables, in which a two-wire current transformer circuit and a three-wire potential transformer circuit are run in pairs for each type of measurement between points "A" and "B" and point "C." At the centralized metering panel in point "C" these cable connections are terminated to feed two current transformer buses and two potential transformer buses from which the necessary taps are made to the recording instruments on the panel. Local metering is provided without interference with the transmitted readings from the older plant "A" and the substation "B" to "C." By the use of special current transformers the combined current transformer load at each point "A" and "B" is reduced to 0.05 amp. for transmission to the metering panel.

When the installation was made current transformers used for remote metering were protected against excess voltage due to a break in the aerial cable circuit (or to an open secondary from any cause) by electronic glow tubes connected across the receiving terminals of the current transformer circuits at the central panel. A rise in voltage across the tubes automatically loads the special transformers.



SCHEMATIC DIAGRAM of transmission facilities for centralized readings

Switch Scheme Provides Flexible D.C.

Extreme flexibility, to provide the range of current, voltage and frequency conditions required in testing of an extensive range of electrical control equipment, marks the power supply to the experimental department of Cutler-Hammer, Inc., Milwaukee, Wis. Key to the flexibility, particularly of the d.c. supply for this department, is an ingenuous switching arrangement that controls the output of several motor-generator sets, allowing them to be grouped in series or parallel on inter-related bus systems in accordance with varying current and voltage requirements.

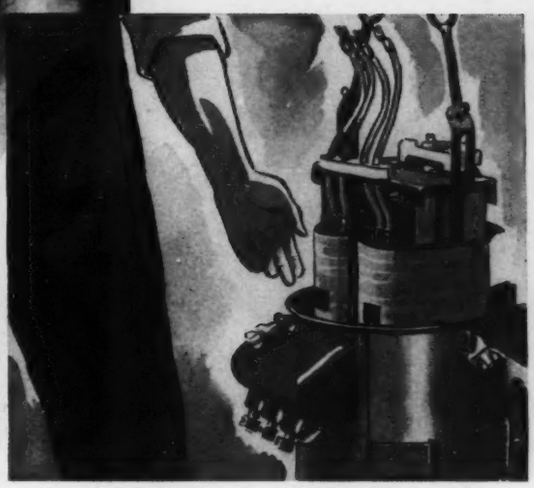
Four m.g. sets and two .25-60-cycle variable-frequency generators supply the department's d.c. and variable frequency requirements. Three of the m.g. sets are 100-kw., 125-volt units powered by 150-hp., 220-volt, 60-cycle synchronous motors. The fourth m.g. set is a 200-kw., 125-volt machine powered by a 300-hp., 220-volt, 25-cycle synchronous motor. Both of the 9-kw., 250-volt, 25-60-cycle variable frequency generators are driven by d.c. motors from one of the 100-kw. m.g. sets.

Output of the m.g. sets is brought to the main d.c. control board. Here switching facilities arranged as shown in the diagram on page 84 make it possible to (1) connect all three 100-kw. m.g. sets in parallel, (2) put all or any of the paralleled units on either the bus system supplying the test circuits or on the system supplying certain d.c. shop equipment, (3) connect any or all of the 100-kw. units in series to provide voltages in 115-volt steps to 345 volts (this is, of course, possible). How-

1 The boss raised the roof one day about the high cost of repairing old transformers. Claimed he could buy new transformers for the money it cost to repair old tubs.

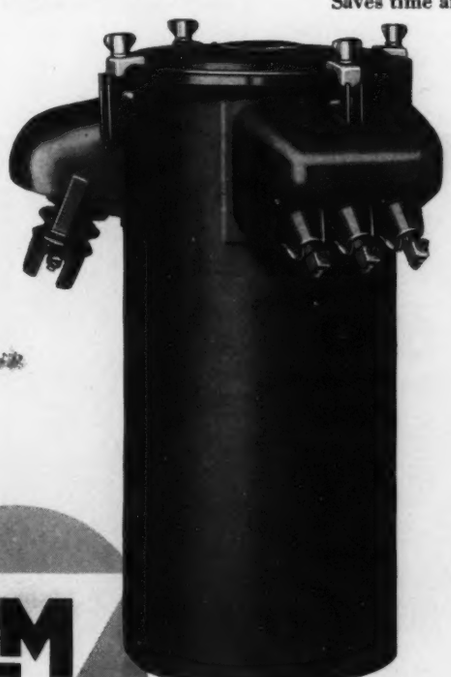
"The Boss raised the Roof about High Repair Cost!"

...ell, I made him feel better. I told the ... how easy and cheap we can repair the ...pany's new L-M Transformers if and ...n those new L-M jobs ever need repair.



3 I showed the boss how the whole L-M Core and Coil assembly can be hoisted from the tank without even removing the bushings. L-M bushings are recessed in pockets, allowing plenty of clearance. Saves time and work right at the start of the job.

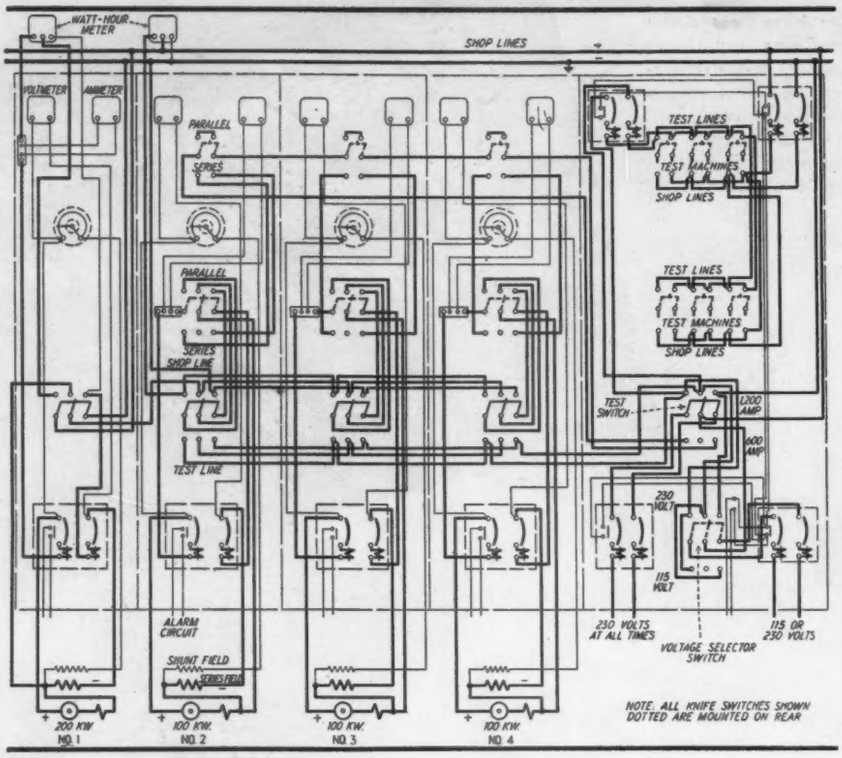
4 L-M duplicate coils is another thing I pointed out. If L-M coils should get damaged you don't buy a whole new core and coil assembly. L-M makes exact duplicate coils that slip over the old core legs. It's a time-saving, money-saving idea.



Today's growing loads put transformers "on the spot". Wherever load rise is particularly rapid there is increased danger of overload and consequent repair costs. And experienced operating men well know that transformer rewind and re-core costs can be prohibitive. That is why the time and money you can save in repairing an L-M Transformer is a major consideration to every man who buys transformers. Look into this important economy feature of L-M Transformers at your first opportunity.

LM

LINE MATERIAL CO.



SWITCHING ARRANGEMENT groups generators to provide flexible d.c. supply for experimental department of control concern

ever, only two of the units are used in series giving 230 volts, (4) connect the paralleled 100-kw. units in series with the 200-kw. unit by interconnecting the 115-volt test bus and the 115-volt shop supply bus, to provide 1600 amp. at 230 volts—otherwise 800 amp. available with two 100 kw. units in series—(5) supply test machines from either the test lines or the shop lines as desired, (6) night lights and stair lights may be thrown to the d.c. bus in event of 60-cycle failure provided 25-cycle is available to operate the 200-kw., 25-cycle driven m.g. set.

To accomplish these six combinations, each of the m.g. sets, with the exception of the 200-kw. unit (which is connected only to the shop power bus) is provided with two triple-pole, double-throw switches and a double-pole, double-throw switch connected as shown.

Main leads of each of the 100-kw. generators are brought out to the center poles of one of the TPDT switches. In one position this switch connects the generator leads to the DPDT switch that allows the 100-kw. units to be connected in series. In the other direction this TPDT switch connects the generator leads of its machine to the center poles of a second TPDT switch, allowing that machine to be connected either to the shop power or the test power bus in parallel with many of the other machines as necessary. It should be again noted, however, that this arrangement applies only to the three 100-kw. m.g. sets. The 200-kw. unit can be connected only to the shop bus.

In addition to the switching equipment on each generator panel two TPDT switches have been provided on a "power board" to interconnect the test and shop power buses or control output of m.g. set connected in series. One switch is designated as "test switch," the other "voltage selector switch." In its "down" (600-amp.) position the test switch brings out the leads of machines in series, thus providing low current supply at 230 volts and higher. In its "up" (1,200-amp.) position this switch connects the test bus to the TPDT "voltage selector switch." The voltage selector switch" in turn supplies 115 volts or 230 volts to the same feeder breaker either by tapping the test bus or by interconnecting it with the shop power bus.

•

Mercury Lighting for Billet Chipping

Close inspection of shining metal surfaces is done under mercury-vapor light at the Briar Hill plant of the Youngstown Sheet & Tube Company, Youngstown, Ohio, where billets are "skinned" to remove mill scale. Billets coming from the chipping machines are inspected for cracks and crevices, from which scale is chipped or "scarfed"* Under mercury-vapor lighting employees report that the cracks in the highly reflecting surface of the billets are easily detected. An average of 30–35 ft.-candles is secured on the work, using 400-watt mercury-vapor lamps in fluted glass high-bay units on 12-ft. centers 20 ft. from the floor. Wattage density is approximately 3 watts per square foot. (The picture was taken in the daytime while the mill was operating, which accounts for the haze.)

* "Scarfing" is burning with acetylene torches.

MERCURY-VAPOR LIGHTING for metal inspection

For the First Time Anywhere

GENERAL ELECTRIC IRON and IRONING BOARD COMBINATION DEAL APRIL 1st to JULY 1st

G-E "DIAL-THE-FABRIC" AUTOMATIC IRON (Cat. No. 119F114) $8.95

G-E "MET-L-TOP" IRONING TABLE (Cat. No. 78X512) $5.95

Total Value $14.90

LIMITED TIME OFFER

BOTH FOR

$9.95

WITH YOUR OLD IRON

PRICE $11.95 WEST OF THE ROCKIES

G-E "DIAL-THE-FABRIC" AUTOMATIC IRON

1. Streamlined.
2. "Dial the fabric" heat control.
3. Compensating thermostat.
4. Moulded handle and thumb rest.
5. Fast heating Calrod unit produces even soleplate ironing temperature.
6. Button nooks to save buttons.
7. Chromeplate finish, attractive, durable.
8. Heel rest to save lifting.
9. Long-life cord set, moulded rubber plug.
10. 1000 watts for faster ironing.
11. Weighs only 4½ pounds.
12. List price $8.95.

G-E "MET-L-TOP" IRONING TABLE

1. All metal—will last a lifetime.
2. Lightweight—warp-proof—fireproof.
3. Vapor-vented—vents carry off steam and aid in faster ironing.
4. Patented folding legs—fold easily without adjustment.
5. Rigid construction—standard size.
6. List price $5.95.

COMPLETE ADVERTISING PROGRAM

THIS OUTSTANDING OFFER is backed by a complete advertising program which includes: Broadside, Cat. Pages, Folders, Handbills, Pennants and Newspaper Ad Mats.

●

See your G-E Distributor at once to tie in with this complete merchandising offer.

GENERAL ELECTRIC

BRIDGEPORT, CONN. ONTARIO, CALIF.

NEW ENGINEERING IDEAS

Buttons Control Generator Voltage

By C. E. VALENTINE
Regulator Engineer, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

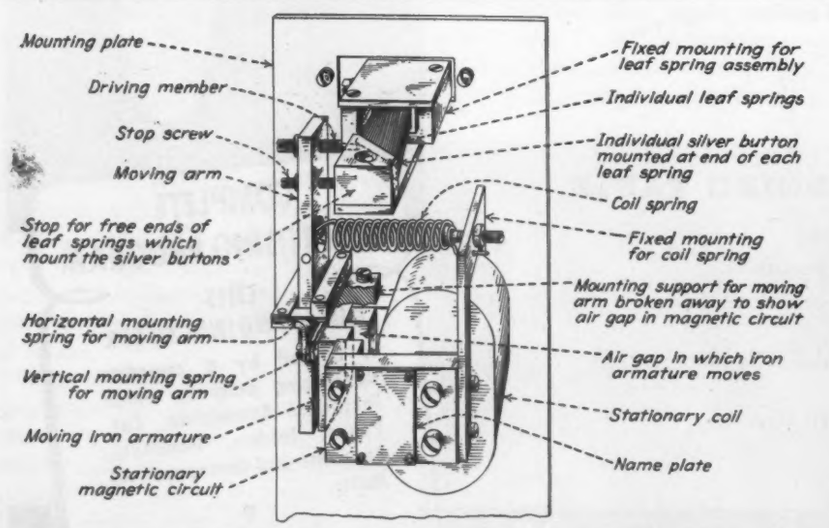
An arrangement of armature-operated silver buttons to control the field resistance offers a solution to the voltage-regulating problems of d.c. generators of a few hundred kilowatts and alternators of a few thousand kilovolt-amperes.

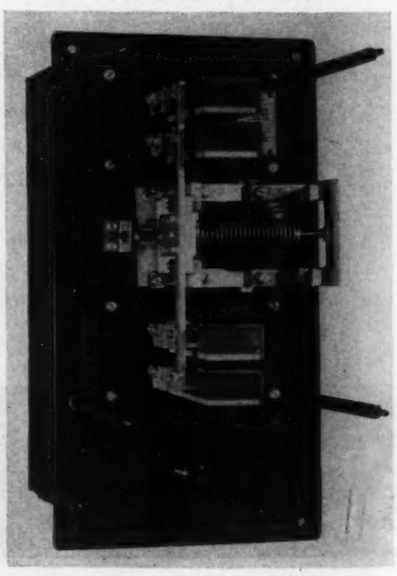
The device, known as the "Silverstat," consists essentially of an electromagnet and armature, a sheaf of individually insulated metal leaves rigidly supported at one end and mounting silver buttons at the free end, and a tapped resistor connected electrically to these leaves. The coil is continuously energized by the voltage under regulation and exerts a pull on the armature that is oppositely restrained by a spring. The armature is supported by a crossed flat spring mounting, thus eliminating pivots and bearings. Upper end of the armature presses against the free or silver button end of the metal leaves. The rigid end of each leaf is connected to a tap on the regulating resistance in the exciter field circuit of an a.c. machine.

With no voltage on the regulator coil, the spring forces the armature hard against the leaves, placing all the silver buttons in contact, short-circuiting the regulating resistance. This condition corresponds to full field or minimum exciter output voltage. With voltage on the coil, the restraining spring is overpowered to some extent, allowing the upper end of the armature to move a fraction of an inch in a direction to decrease the pressure on the leaves with their silver buttons. This causes the leaves on the right side to separate sufficiently to allow their buttons to separate, thereby inserting their respective resistance elements into the exciter or generator field.

Amount of resistance inserted in the exciter field is thereby determined by the relative pulls of the voltage coil and the spring. As the generator voltage changes, more or fewer silver buttons make contact, decreasing or increasing the exciter field resistance to restore the generator voltage. The regulator achieves its control with virtually no moving parts, the only motion being that of the armature, and that being but a fraction of an inch.

The regulator is semi-static; that is, it operates only when there is a need for regulating action. The buttons at no time interrupt a current circuit;


Mounting plate
Driving member
Stop screw
Moving arm
Stop for free ends of leaf springs which mount the silver buttons
Horizontal mounting spring for moving arm
Vertical mounting spring for moving arm
Moving iron armature
Stationary magnetic circuit
Fixed mounting for leaf spring assembly
Individual leaf springs
Individual silver button mounted at end of each leaf spring
Coil spring
Fixed mounting for coil spring
Mounting support for moving arm broken away to show air gap in magnetic circuit
Air gap in which iron armature moves
Stationary coil
Name plate



Voltage regulator uses silver buttons on flat leaves to control excitation
Tested first on generators of a few hundred kilowatts, units (right) are being applied to self-excited d.c. generators of up to 300 kw. at 3,600 r.p.m., to separately excited d.c. generators of up to 7,500 kw. at 1,200 r.p.m. and to three-phase alternators of 10,000 kva. at 1,800 r.p.m. or 12,500 kva. at 3,600 r.p.m.

FLAMENOL

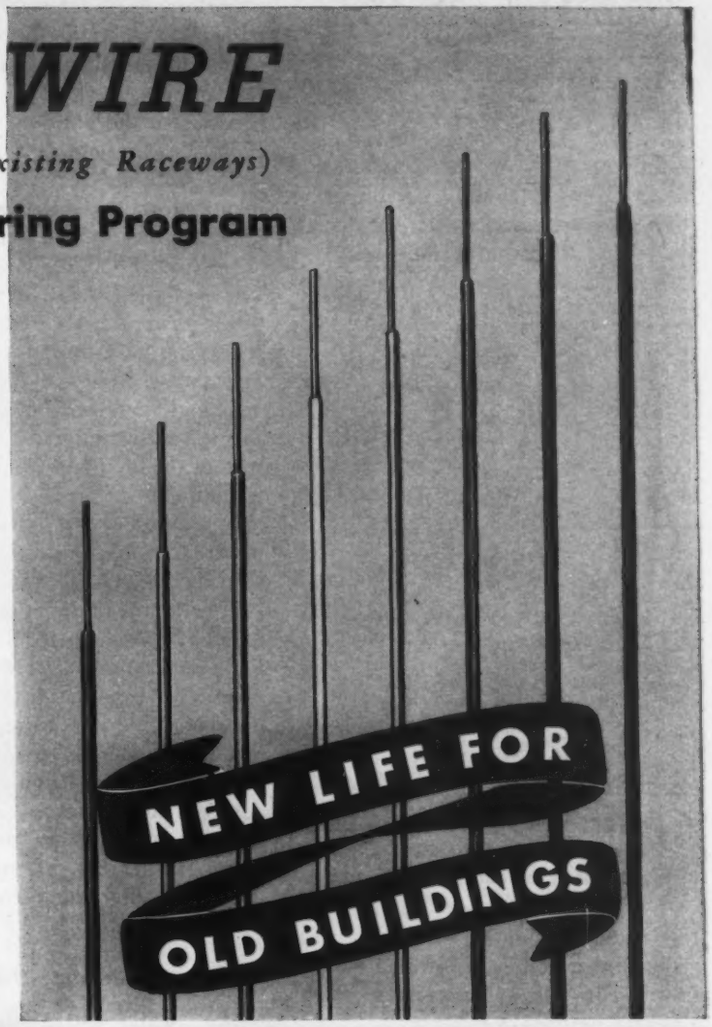
BUILDING WIRE

(Small Diameter—For Rewiring Existing Raceways)

Contributes to Great Rewiring Program

Available in Sizes 14 to 4/0 Inclusive

General Electric is co-operating with the industry in launching a great rewiring program by offering small diameter Flamenol Building Wire. With it wattages can be increased inexpensively. The reduction in diameter size permits the installation of more wires and wires of larger capacity in existing raceways (pending 1940 Code). See table below for comparative over-all diameters.



INCREASED COPPER

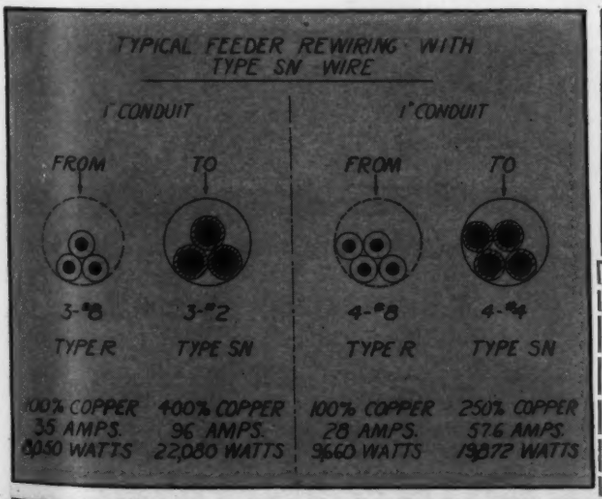
Now effective copper in existing raceways can be increased as much as 400 per cent by rewiring with small diameter Flamenol Building Wire. The rewiring job can be complete including new feeders, new sub-feeders and new branch circuits because Flamenol Building Wire is available in sizes 14 to 4/0 inclusive.

SYNTHETIC COMPOUND INSULATION

Small diameter Flamenol Building Wire is insulated with a plasticized polyvinyl chloride compound which has high dielectric and mechanical strength. It is tough, long aging, flame retarding and is resistant to oils, acids, alkalies and moisture. The compound serves both as an insulation and as a finish. Flamenol Building Wire is available in a variety of bright, permanent colors. Color goes all through the insulation and can easily be determined by cleaning or scraping if the wire becomes soiled.

ADDITIONAL INFORMATION

For samples and further information see the nearest G-E Merchandise Distributor or mail the coupon below.



COMPARISON OF DIAMETERS

Size AWG	Approximate Overall Diameter (In.) Rubber Covered Types R, RP, RH	Approximate Overall Diameter (In.) Flamenol Type SN	Size AWG	Approximate Overall Diameter (In.) Rubber Covered Types R, RP, RH	Approximate Overall Diameter (In.) Flamenol Type SN
14 Sol.	.19	.130	1 Strd.	.56	.496
12 Sol.	.21	.147	1/0 Strd.	.60	.537
10 Sol.	.23	.168	2/0 Strd.	.65	.583
8 Strd.	.32	.246	3/0 Strd.	.70	.634
6 Strd.	.40	.314	4/0 Strd.	.76	.692
4 Strd.	.45	.363		up to 2,000,000 CM	
2 Strd.	.51	.423			

General Electric Company
Section W-0135
Appliance and Merchandise Department
Bridgeport, Connecticut

Sirs: Please send me samples of Flamenol Building Wire.

Name.....

Address.....

City.....State.....

GENERAL ELECTRIC

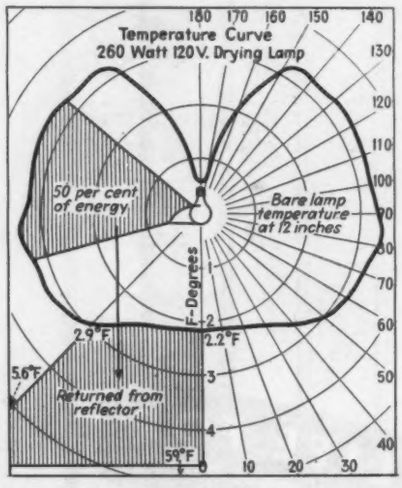
they are, in effect, tap-changing devices on a resistance that at all times completes the circuit.

•

Chart Temperature Around Infra-Red Lamp

By EUGENE D'OLIVE
Testing Department,
Commonwealth Edison Company, Chicago

Effects produced upon temperature and energy distribution by the addition of a reflector to a bare 260-watt, 120-volt, carbon-filament, infra-red drying lamp are shown graphically in



Addition of reflector to bare infra-red lamp boosts temperature at distance of 1 ft. from lamp and along the axis from 2.2 to 59 deg.

the accompanying chart, which was made up from tests at the lighting laboratories of the Commonwealth Edison Company, Chicago.

With the bare lamp alone, temperature registered by a thermopile at a distance of 1 ft. from the filament center is shown by the "distribution" curve to vary from practically zero near the base of the lamp to a maximum of 3.4 deg. F. at an angle of about 83 deg. from the nadir. Temperature at a distance of 1 ft. along the axis of the lamp is 2.2 deg. and at the 45-deg. axis 2.9 deg.

Upon adding a 7½-in. colored aluminum reflector temperature 1 ft. away from the lamp at the vertical axis of the reflector was found to be 59 deg. F. and along the 45 deg. line to be 5.6 deg. F. With the addition of the reflector it was found that approximately 50 per cent of the total energy of the lamp was delivered to a useful area corresponding to a 45 deg. cutoff.

Heat Building by Thermal Storage

The use of electricity for the heating of buildings by thermal storage has been adapted at the new headquarters of the South Metropolitan Electric Light & Power Company, Ltd., at Lewisham, England, reports *Engineering* (British). The central heating of the building is effected by hot-water radiators, which are supplied from an electrode thermal-storage system, the entire equipment being supplied by the General Electric Company, Ltd., London.

The boiler house equipment consists of a 200-kw. electrode water heater, a 4,800-gal. storage cylinder, circulating pumps, automatic control gear and main switchgear. The equipment is fully automatic. The temperature of the flow water to the radiators is automatically adjusted to suit the temperature of the outside air. The electrode water heater is connected directly to the 400-volt, three-phase supply mains. It consists essentially of a mild-steel horizontal shell with fixed and movable electrodes. The load is varied by rotating the movable electrodes, which are chain-driven through reduction gear by a small motor. The storage cylinder, which is adjacent to the heater, is sufficiently large to maintain the hot water supply to the heating system for four or five hours after the current has been switched off.

Pumps Circulate Hot Water

Hot water circulation between heater and storage cylinder to radiators is effected by two motor-driven pumps. A third motor-driven pump acts as standby. The temperature of the water circulated to the heating system is controlled by a mixing valve. An over-riding control operates in accordance with variations in the external air temperature.

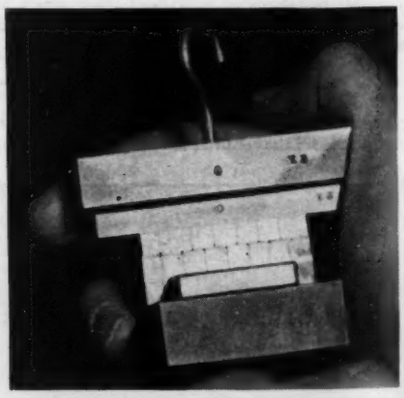
The main switchgear consists of a 300-amp., 400-volt oil circuit breaker, mounted in a sheet-steel cubicle and arranged for solenoid operation. On a separate panel is the control gear for the pump motors, consisting of direct-to-line starters and change-over switches for the secondary and stand-by pumps. The water heating equipment is mounted in a sheet-steel cubicle and consists of a time switch which opens and closes the main circuit breaker at the end and beginning of the off-peak period. The primary pump comes into operation when the heater is switched on. The load-control gear is arranged so that the load is automatically reduced to 30 per cent of full load before the main circuit breaker is opened. Once the supply is switched on the position of the electrodes is controlled by a load-regulating relay to keep it constant.

Protection against electrical faults consists of over-current relays, out-of-balance or earth-leakage relays, excess temperature thermostat and pump and motor failure device, all of which operate through a lock-out relay. In the event of a fault, the plant is locked out of operation and visual indication given to the attendant.

•

Increase Strength of Alnico Magnet

A new mounting of brass and iron in which the magnetic flux passes through many air gaps in bridging from pole to pole, instead of the usual two, is responsible for the greatly increased power of this new sintered Alnico magnet assembly. Developed by the General Electric research laboratory, it will lift and



MORE AIR GAPS make for increased strength of Alnico magnet

hold 4,450 times its own weight. Sintered Alnico is an alloy of aluminum, nickel and iron as the basic or essential ingredients and is made by pressing together the powdered metals and heating almost to the melting point. While the new assembly is not a commercial development, it is regarded of importance in foreshadowing newer applications of permanent magnets.

Every house needs

Westinghouse

ELECTRIC ROASTERS HELP RANGE SALES

Report Typical Utilities Interviewed by Westinghouse

Partners
... IN THE SALE OF
ELECTRIC COOKING

In a recent Westinghouse survey among utilities successful in promoting electric cooking, the opinion was almost unanimously expressed that roasters helped range sales. The reasons are simple enough to bear in mind in selling the cleanliness and economy of electric cooking to American homemakers.

Here again is expert confirmation that owner-satisfaction is a powerful selling force. People prefer to buy what their friends recommend. Get more users of Westinghouse appliances and you'll have more satisfied customers and more sales.

Westinghouse *Electric* Roaster·Oven

ONE OF THE COMPLETE LINE OF WESTINGHOUSE HOME-PROVED APPLIANCES

LOAD BUILDING

Baltimore Stadium Job Boasts 325 Kw.

By J. CARL FISHER
Illuminating Engineer Consolidated Gas, Electric Light & Power Company, Baltimore, Md.

Football field floodlighting, floodlighting of seating section, façade floodlighting and parking lot illumination provide a new load of 325 kw. at the Baltimore football stadium.

The field lighting consists of 260 1,000-watt inclosed type Electric Service Supplies floodlights on six towers. The center towers carry 56 lights each and the end towers 37 lights each. The lower bank of lights in each tower is 110 ft. above the playing field. The center towers are 210 ft. back from the side line of the field and the end towers a still greater distance. Burning at 10 per cent overvoltage, the floodlights provide an average of 26 ft.-candles of horizontal illumination on the football field. The average illumination 15 deg. from the vertical plane, which is more nearly that which is effective for the players and spectators, is 43 ft.-candles.

Seats are lighted independently by 1,000-watt open type Benjamin floodlights when the towers are not turned on. Sixteen gates are illuminated by two reflectors each of the type used for lighting pump islands in gasoline service stations, with 300-watt lamps on gate posts 12 ft. above ground.

The 33d Street façade is floodlighted by ten 100-watt type floodlights, each having a 200-watt auxiliary lamp. A large parking lot on each side of the stadium is floodlighted.

Entire installation of 325 kw. is fed through one main and two subsidiary substations. Each tower can be controlled independently and, of course, independent control is provided for all the other groups of lights, such as seats, gates, etc. The towers on each side are fed from the substation outside the stadium near the middle tower. The third substation is in the basement in the Administration Building. The total cost of the installation, we understand, was approximately $43,000.

JOINING THE PARADE of companies with large, well-lighted open-air stadiums, Consolidated Gas, Electric Light & Power of Baltimore serves 325 kw. of load at Baltimore Stadium. Lower photo, of facade, shows added load available in stadium jobs

Appliance Show Proves Its Worth

South Bend's first purely electrical appliance exposition, sponsored by the Indiana & Michigan Electric Company, proved so effective in starting off the spring appliance campaigns of local electrical dealers that its continuance as an annual event seems assured.

Planned as purely a dealers' show, with the major part of the expense and promotion carried by the utility as a part of its dealer co-operative program, the exposition lasted for six days and attracted upward of 23,300 people from South Bend and surrounding towns. Displays representing an investment in excess of $500,000 were assembled by the 30 participating dealers.

Index to the success of the project is the classification of appliance units

Every house needs
Westinghouse

HERE'S HOW I PAVE THE WAY

FOR MANY A WATER HEATER SALE!

FIRST: I see that every one of my good prospects gets a copy of the new Westinghouse "Hot Water Helps" Book. *There's* a mailing that women *read* because it gives them dozens of helpful household and beauty hints . . . all using HOT water, of course. Then I *call on* these prospects, and . . .

I SAY: How are you, Mrs. Jones. Have you read the new "Hot Water Helps" booklet we mailed you a few days ago?

SHE SAYS: Yes . . . and I'm keeping it, too . . . it's just *full* of helpful suggestions. Why, I never dreamed hot water could help in so many ways! Only, it set me to wondering about 140° HOT water. You see, with our old heater . . .

THEN: I sail into my story on Westinghouse Electric Water Heaters. And I get to the dotted line in a hurry! That "Hot Water Helps" Book has done a beautiful job of selling Mrs. Jones on the importance of having plenty of 140° HOT water, and on the fact that she's got *almost* what it takes to get it at low cost with a Westinghouse. It sure paves the way for easier, quicker water heater sales!

TRY THIS **NEW** APPROACH TO EXTRA PROFITS

Every woman wants to be more beautiful. Every woman looks for easier ways to keep her home neat and attractive.

The "Hot Water Helps" Book gives your prospect what she wants—beauty and health hints, short cuts to easier dishwashing, house cleaning, cooking. The book is practical, authentic, prepared with the help of famous women's magazines.

And every helpful suggestion sells the need for plenty of 140° HOT water!

That's why your prospect is **easier to close** when you show her how economically a Westinghouse will give her the 140° HOT water she needs!

It's a new approach to water heater selling, built into a plan that's ready to boost profits for you beginning right now. Get the details from your distributor, or write Westinghouse Electric & Mfg. Co., Merchandise Division, Mansfield, Ohio, Dept. 139.

TUNE IN "MUSICAL AMERICANA", EVERY THURSDAY EVENING, N. B. C. BLUE NETWORK

Westinghouse *Home-proved* **Water Heaters**

"The Line of Least Resistance"

sold during, or as a result of, the show:

Ranges	15	Miscellaneous	12
Water heaters	3	Pumps	1
Refrigerators	28	Ironers	3
Washers	10	Roasters	2
Vacuum cleaners	19		
Radios	11	Total units	124

Rules governing the exposition were mildly strict as expositions go. Only South Bend and Mishawaka electrical dealers were allowed to display. Each dealer was limited to one booth, about 20x15 ft., location of which was determined by drawing lots. Dealers each contributed $30 to show expenses, and to insure that the attendance was limited to people interested in appliances only door prizes and premium gifts were prohibited. Radios on display were not played as radios; they could be demonstrated only by connecting them to a master record player so that all instruments played the same. This eliminated the confusion arising from a babble of miscellaneous radio programs. Major exhibits of the display were provided by electrical appliance manufacturers. Each was allowed a centrally located 20x30-ft. booth space. Dealers' displays were grouped around these theme center exhibits.

•

85 Hp. Required for 300-Ton Quarry

By B. H. MILLER

Power Sales Engineer Consolidated Gas, Electric Light & Power Company, Baltimore, Md.

Rural industrial load building as evidenced by 85 hp. of connected load recently developed in a local quarry is rapidly on the upward trend. This quarry at one time was operated by gasoline tractors, but a few years ago purchased power was made available and the owner began to motorize his equipment. Recently, however, the installation of a 40-hp. motor replacing a gasoline-tractor drive on a crusher marked the final step in the complete electrification of crushers, elevators, screens and water pumping.

A total connected load of 85 hp. serves reliably and economically in a quarry with a production capacity of 300 tons per day.

CONNECTED LOAD of 85 hp. has been developed in quarry at site of this crusher. Purchased power replaced gasoline-tractor drives

•

Utah Power & Light in Stoker Campaign

Utah Power & Light Company is an active participant in a co-operative, automatic-coal-stoker campaign. While the ½-hp. motor which constitutes the electric load resulting from the sale of one residential stoker might not in itself justify much promotion in this field, the company has found that the automatic stoker is frequently the pilot for electric usage in the kitchen.

Utah Power & Light operates in a gas territory, but coal is a major local industry and utilities, railroads and coal and stoker dealers share an interest in its welfare. Hence it was that these groups banded together for a group promotion.

Timed for maximum effect just prior to the building peak which occurs in Utah in September, and for continuing effect through the year, the campaign was concentrated on three fronts: (1) The speculative builder, (2) the trade, including contractor builders, architects, building supply houses, plumbers, electrical contractors, etc., and (3) the home-owning and home-buying public.

Advertising and selling appeals coupled the economy of low-cost coal with the convenience and cleanliness of the automatic stoker. A financing plan permitted monthly payments of about $8.

A meeting of stoker dealers preceded the campaign to reach the builders and the trade with personal letters emphasizing the personal interest of the particular individual address. The campaign to the public was carried on via newspapers and radio.

Because low first cost had been indicated as the principal reason for installing gas, the stoker campaign to the public emphasized low operating cost. Advertisements offered a free estimate of automatic coal heating costs for a particular home.

Supplementing the above media was a mail broadside to the trade and 24-sheet posters on billboards.

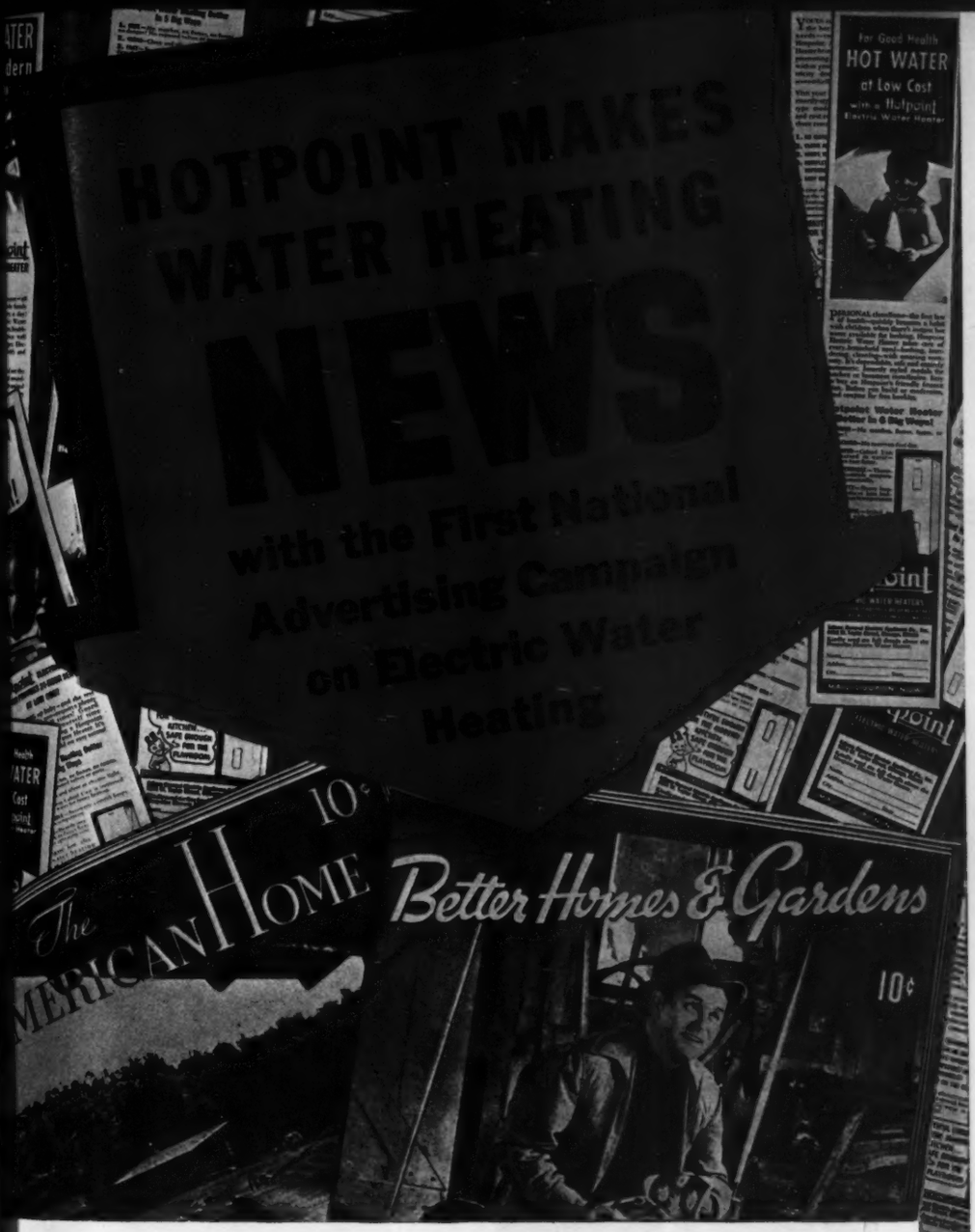
The percentage of stokers in new homes has been suffering a steady decline (25 to 20 to 15 per cent) through the last three years, and it is the hope of the participants that the co-operative campaign will turn this trend.

•

Electric Furnace for Melting Economy

In an Eastern metal-working plant a 300-lb., oil-fired brass melting furnace was recently replaced by a 400-lb. capacity, 170-kva. electric arc furnace of the Detroit type. This resulted in a reduction in melting time of two-thirds, a 50 per cent cut in labor cost per ton, 14.5 per cent cut in metal shrinkage and a 40 per cent drop in fuel or equivalent electrical energy cost. Better control over the composition of melt was also obtained. Summarized results are:

	Fuel Oil Melting	Electric Melting
Type of furnace	Crucible	Arc
Melting time, hours	1.5	0.5
Fuel used per ton (gal.)	150	—
Energy used per ton (kw.-hr.)	—	479
Cost of fuel per ton (cents)	6.4	—
Cost of electricity per ton (cents) (0.8-mill rate)	—	3.83
Maintenance cost per ton (cents)	0.32	0.65
Labor cost per ton (cents)	6.25	3.12
Lining cost per ton (cents)	0.59	0.65
Crucible cost per ton incl. electrodes (cents)	1.60	1.06
Total of above costs per ton (cents)	15.16	9.31
Metal shrinkage in per cent	2.2	1.88



Nearly 25,000,000 Advertising Messages

HOTPOINT is the first Electric Water Heater manufacturer to use national advertising to stimulate sales for YOU. Every month, beginning in April, Hotpoint Water Heater National Advertising appears in the two well-known home magazines, AMERICAN HOME and BETTER HOMES AND GARDENS.

People who are thinking of building and remodeling read these two home-building magazines. That is why they were selected to carry the advertising of Hotpoint Electric Water Heaters.

There was a large increase in the number of homes built in 1939. There will be a larger increase in 1940.

AMERICAN HOME and BETTER HOMES AND GARDENS reach these prospects with a total of nearly 25,000,000 Hotpoint Water Heater advertising messages. Buyers in your community will see these messages, so get ready NOW for YOUR share of Hotpoint Water Heater sales. See your distributor or write for information today!

New "SAFE-T-SEAL" Bond for Calrod Water Heating Units

"SAFE-T-SEAL" Bond, a new non-conducting material for sealing Calrod Units, greatly increases the life of the unit, and reduces possibility of interruptions in the water heater service.

More Hotpoint features that make sales for you

CALROD, Hotpoint's airtight heating unit, is immersed directly in the water inside the tank. All heat generated is delivered to the water. No waste. No flame. No fire hazard.

THERMOSNAP, Hotpoint's automatic temperature control, makes Hotpoint Water Heaters safely automatic.

DESIGNED by industry leaders and world's largest manufacturer of electric water heaters.

Hotpoint has pioneered more exclusive features than any other manufacturer in the field.

Water heating activity greater now than ever before in history!

More building activity—Boom-time home building means more sales for you. New homes need water heater service. Hotpoint national advertising in home magazines helps you sell.

More people recognize advantages—The old saying, "A satisfied customer is your best salesman" means something to Hotpoint retailers. There are more owners—more satisfied customers—of Hotpoint Water Heaters than any other make.

More utility executives realize the value of Water Heater load each day. This extra load increases net earnings with small additional investment. Utilities benefit—1. On Sales. 2. On Load.

EDISON GENERAL ELECTRIC APPLIANCE CO., Inc.
5618 West Taylor Street, Chicago, Illinois

Enter the MKB Window Display Contest

Hotpoint will pay duplicate prizes to all National winners who use exclusive Hotpoint window displays in the MKB Contest. Make more than one entry. Improve your chances to win.

Hotpoint

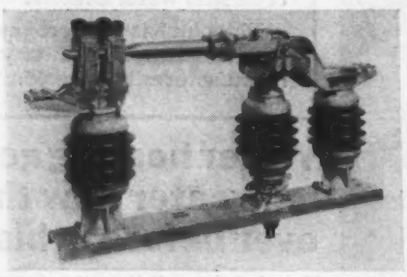
AUTOMATIC ELECTRIC WATER HEATERS

ELECTRIC RANGES · REFRIGERATORS · WASHERS AND IRONERS · CLOTHES DRYERS · DISHWASHERS · ELECTRASINK

NEW EQUIPMENT

Contact Switch

The new blade mechanism is said not only to convert the rotating motion of the operating insulator to the vertical



MK-39 high-pressure contact switch, in all voltages up to 161 kv. and current capacities, up to 2,000 amps. **Delta-Star Electric Co.**, Chicago, Ill.

swinging of the blade, but it also turns the tubular blade to make high-pressure contact. The blade hinge end also has high-pressure contacts. By means of a "high spotted" cam, high pressure is created in the closed position only. There are no stops to limit the swing of the blade as it approaches closing position just before final turning or twisting movement to make high-pressure contact, said thus to give smooth operation without shocks or jars to the porcelain insulators.

•

Switchgear

MI-9 switchgear; available for protection of circuits up to 5,000 volts and 50,000 kva. **General Electric Co.**, Schenectady, N. Y.

Important design improvement is the fact that all buses and connections are now completely insulated; the main bus is covered with a molded insulation; all bus connections are covered with two-piece molded covers, filled with compound.

•

Multiple-Range Ammeter

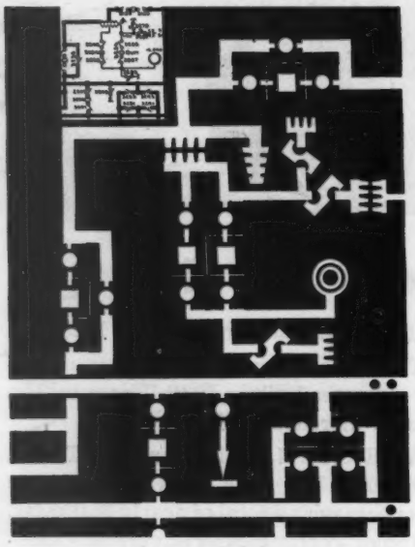
"Micro-Tester;" Model 280 multiple range ammeter provides readings in five different ranges, from fractions of an ampere up to 25 amps. **Simpson Electric Co.**, Chicago, Ill.

A current transformer and an indicating instrument have been combined in a small a.c. multi-range ammeter. It measures 2⅞x5¼x1¾ in., and weighs 20 ounces. Companion testing instruments, all the same size, can be combined in sets of three to measure current, voltage and resistance.

•

Control Systems

New manually operated systems comprise multi-colored ball-unit indicators mounted in panelboard sockets, with a novel diagrammatic arrangement of conductor lines and symbols, heat-cemented in relief on prefabricated front-plates. For load dispatching in electric power plants, three-color plastic spheres are revolved by thumb or finger, exposing the desired colored spot—red, green or yellow—to indicate closed, open or grounded apparatus. For steam power lines and other



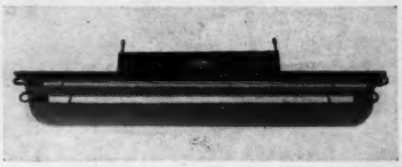
"Uniturn" control system; complete panelboards or prefabricated parts for erection on sub-panels in the field. **Braidwood Stamp Co.**, Perth Amboy, N. J.

industrial panelboard code displays two-color units, red and white, show open and closed valves, etc. Boards can be kept up to date by making extensions in the field.

ELECTRICAL EQUIPMENT BUYERS look first in "Electrical World" *Electrical Buyers Reference* for names, addresses and products of manufacturers.

Fluorescent Lighting

These lamps are available in blue-white or white and are interchangeable in single and twin fixture units. The lamps may be



85-watt, 58-in., type RF fluorescent lamp in single or twin fixtures. **General Electric Lamp Dept.**, Nela Park, Cleveland, Ohio, and **Westinghouse Electric & Mfg. Co.**, Lamp Division, Bloomfield, N. J.

operated on either 105-125 volt or 210-250 volt, 60 cycle a.c.

•

Remote Control

A new device, type SC, for remote control of Wilson "Hornet" arc welders. **Wilson Welder & Metals Co., Inc.**, 60 East 42d St., New York, N. Y.

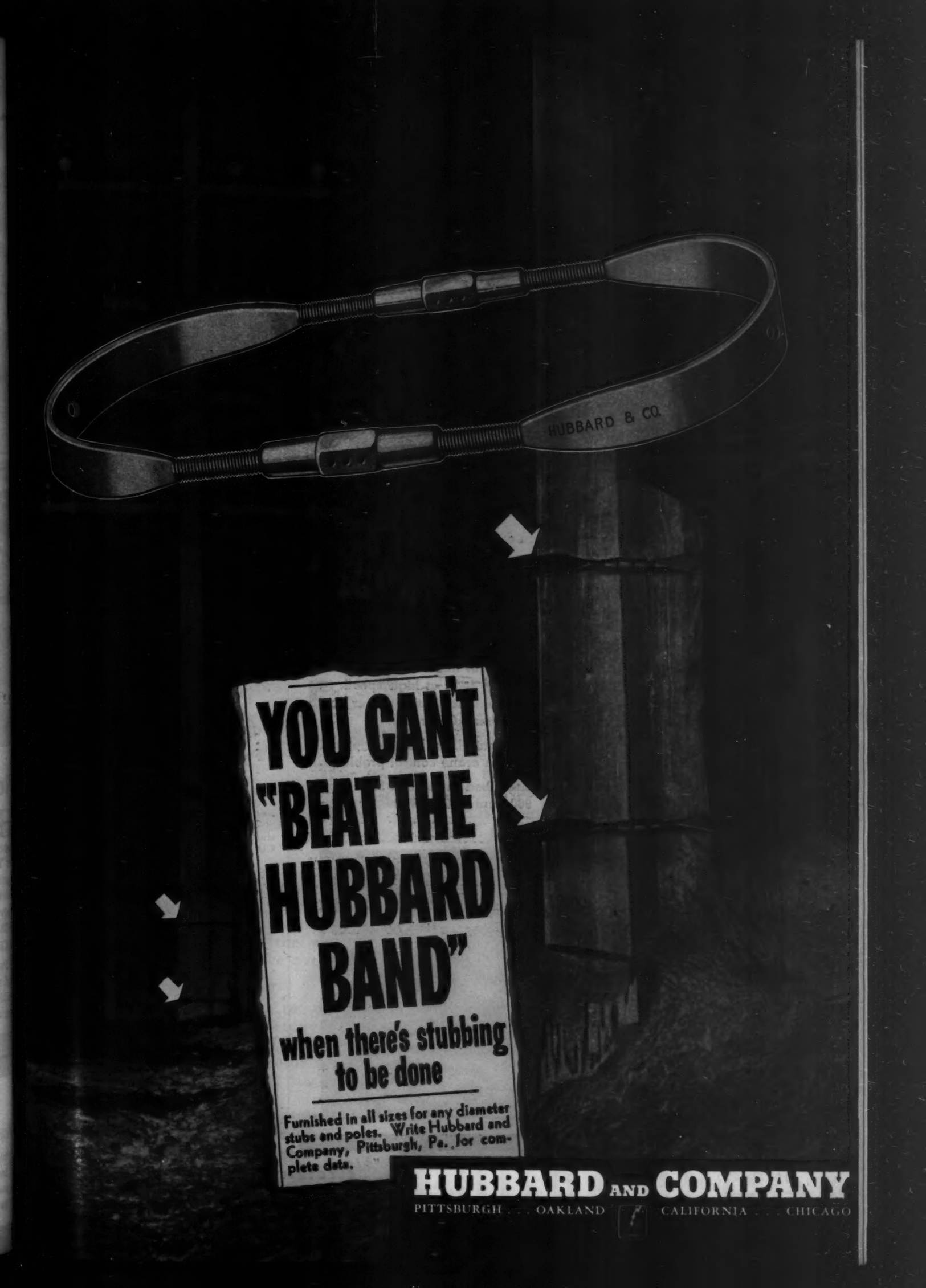
To utilize this device the handwheel, which governs the control pole of the standard welder, is replaced by the reversible motor-driven type SC remote-control device. It is said to allow minute adjustments in current output by touching one of the two contacts on the electrode holder to the ground. The 1/80-hp. electric motor which is used to operate the control pole is protected by two limit switches and by a slip clutch to prevent damage when the end of the range is reached.

•

Circuit Alternators

Type H and HSB circuit alternators alternate or transpose two two-wire electric circuits after each cycle of operation. **Automatic Control Co.**, 1005 University Avenue, St. Paul, Minn.

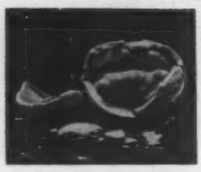
The type H circuit alternator is a separately mounted instrument designed to be wired to the controller and the pump motors or circuits to be controlled. It is operated by closing the solenoid circuit after each cycle of operation. One of the control units (pressure switch or float switch) must have an extra reversed circuit to close the alternator solenoid circuit when the other circuit opens to stop the pump. Type HSB (built into type SB "Floatrol") will alternate the pumps and bring in the second pump when needed. It is a complete two-pump alternating-


HUBBARD & CO.
YOU CAN'T "BEAT THE HUBBARD BAND"
when there's stubbing to be done
Furnished in all sizes for any diameter stubs and poles. Write Hubbard and Company, Pittsburgh, Pa., for complete data.
HUBBARD AND COMPANY
PITTSBURGH . . . OAKLAND . . . CALIFORNIA . . . CHICAGO

You Can Set a Gun or Crack a Walnut—

This 250-Ton Hammerhead Crane is used to set guns, turret heads, etc., at the Puget Sound Navy Yard, Bremerton, Wash. Controllers by EC&M of Cleveland.

with this EC&M CONTROLLER



Of course, operators don't use cranes to crack walnuts but this statement expresses the fine degree of accuracy you have in an EC&M Magnetic Controller for hoist motions of cranes. Under any load condition, this controller is unequalled in its ability to permit short, accurate, inching movements.

And equally as important is the ability of this controller to permit lowering of light loads or the empty hook at high speed. . . thereby permitting more trips per minute. Substantial power savings are also obtained with this EC&M Crane Controller.

For accuracy, low up-keep cost in controlling both large and small cranes, consult EC&M-specialists in crane control problems.

Magnetic Crane Controllers are described in Bulletin 920, Manual-type Controllers in Bulletins 960 and 980. Write for your copies.

Steel Mill Crane, EC&M Controlled, setting annealing furnace-top accurately in position.

THE ELECTRIC CONTROLLER & MFG. CO. E&M CLEVELAND, OHIO

HEAVY DUTY MOTOR CONTROL FOR CRANES, MILL DRIVES AND MACHINERY • BRAKES • LIMIT STOPS • LIFTING MAGNETS AND AUTOMATIC WELD TIMERS.

control unit for pumping into or out of sumps or tanks. The installation wiring necessary, states the company, is connecting the two two-wire starter circuit and two 220-volt line wires to the coded wires in the base of the control.

•

Starter

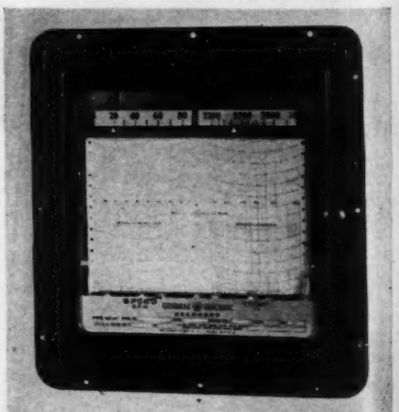
New features claimed for this starter are: (1) A new type of cover which is said to permit group panel mounting with minimum clearance, (2) loosening of one screw permits removal of the operating mechanism for easy wiring and conduit work, (3) the overload relay has been made smaller in size. Available in the following types of cover control: Reset only for two- or three-wire remote control; start and stop reset buttons for three-wire control, and three-position selector switch for manual-off-automatic local control or two- or three-wire remote control.

Across-the-line starter for the control and protection of polyphase squirrel-cage motors up to 5 hp. Cutler-Hammer, Inc., Milwaukee, Wis.

•

Duplex Recorder

Essentially this recorder consists of two separate type CD instruments placed side by side in one case and arranged to record on a single chart. Timed by a high-torque Telechron motor, or an eight-day spring clock, the chart carriage feeds the paper at 1, 2, or 3 in. per hour. Instead of a single wide chart, a separate standard type CD chart carriage and chart may be had



Duplex recorder, type CD-37, for recording simultaneously kilowatts and rkva. or kilowatts and frequency, or volts and amperes. General Electric Co., Schenectady, N. Y.

HOW MUCH ARE YOU SPENDING *for Wattless Current?*

SMOOTHER REGULATION at lower cost is delivered by these Allis-Chalmers Step Regulators for a midwestern utility

Western Utility Finds How They Could Have Saved $150,000! Find Out How You Can Save Money with Allis-Chalmers Step Regulators . . . that Need Only About 1/3 the Exciting Current Required by Any Other Type of Single-Phase Low Voltage Regulator on the Market Today!

Like every other utility today you want to get efficient regulator operation at the lowest possible maintenance cost! And yet here's one really substantial item on the wrong side of the ledger that you may have overlooked — exciting current!

Here are the facts! Step-Type regulators take less exciting kva than other types of regulators— only about 1/3 the current! And Allis-Chalmers makes the only step-type regulator for single-phase low voltage feeders on the market today!

A typical example of the savings a large system could make using step regulators is that of the western utility that recently found how they could have saved $150,000.

Before step-type regulators had been developed, this utility installed a large number of regulators of the older type. These regulators required 30,000 kva for excitation ... step-type needed only 10,000. That difference of 20,000 kva required fixed capacitors costing about $150,000 to supply the reactive current!

But, even if fixed capacitors hadn't been used, that 20,000 needless kva meant an extra burden on the entire system ... and just to carry the costly load of wattless current!

Utilities Switch to Allis-Chalmers!

No wonder utilities all over the country are switching to Allis-Chalmers Step-Type Regulators! They know about the 5/8% Half-Cycling Steps that give smooth, almost stepless regulation . . . the extra large, non-arcing contacts that mean extra years of contact life!

Get the whole story on how you can cut your excitation losses . . . give better service with Allis-Chalmers Step-Type Feeder Voltage Regulators! Write for Bulletin 1183-A!

1042

INCREASE YOUR REVENUE WITH ALLIS-CHALMERS 5/8% HALF-CYCLING STEP REGULATORS

TRANSFORMER DIVISION

ALLIS-CHALMERS

MILWAUKEE · WISCONSIN

A PIKE POLE with
Automatic Guard
Exclusive design and construction. Adds utility and value. Gives increased safety. Protects point of the pike against damage—strengthens head when pole is in use. Forged, heat treated steel spike—sturdy Fir handles—sanded and lacquered in lengths from 12 to 20 feet. For greater service life, added value, specify
STURDETOOLS
a TRUE TEMPER PRODUCT
Automatic Tubular Pike Pole guard is shown in the phantom view below. Extremely simple in operation, it gives positive protection to the point of the pike.
Distributed by
JOSLYN MFG. & SUPPLY COMPANY
Executive Offices
20 North Wacker Drive • Chicago, Illinois
Branches and Warehouses with Complete Stocks in Principal Cities of the United States

for each element. For use wherever it is desirable to obtain synchronism between two separate records, or where two separate recording mechanisms are required in a single case.

•

Heavy-Duty Contactors

Heavy-duty d.c. magnetic contactors; "Series 200," type SM. **Westinghouse Electric & Mfg. Co.**, East Pittsburgh, Pa.

Among improvements made in this line are: Armature overtravel of the contactor is increased, contact tips are larger and nitrided bearings are employed; the blowout coil is brazed to the contact support.

•

Goggles

No. 323 "Coverglas" goggles for protection for gas welders who wear glasses. **American Optical Co.**, Southbridge, Mass.

The goggle is lightweight, fitted with "Noviweld" lenses, chemically compounded to protect against glare and invisible infra-red and ultra-violet rays. It is made to fit over any style of spectacle and claimed to protect the eyes from flying sparks and scale, light rays and glare.

•

Fluorescent Controls

New complete series of controls for use with all sizes of fluorescent lamps. **Wiremold Co.**, Hartford, Conn.

This line includes a complete series of controls with a power factor of 90 per cent or more for both single lamp operation and two lamp split-phase operation. Also included are low power factor units. A new development claimed is the compactness of two-lamp controls to fit in the company's No. 3,000 fluorescent lighting channel.

•

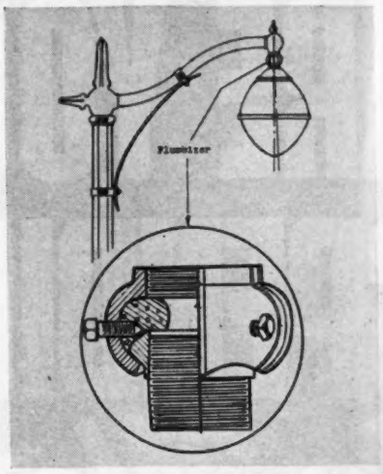
Portable Printer

This printer uses Ozalid sensitized papers and cloths. The light source consists of six specially developed lamps. A new feature is a dry developing chamber, located behind the metal reflector, thus utilizing the heat generated by the light to vaporize the developing agent. An additional feature is a time switch, which allows the length of exposure to be automatically regulated.

"Elpro" portable printer for reproducing engineering drawings, letters, maps, etc. **Ozalid Corp.**, Johnson City, New York.

Street Lighting

The purpose of this new device is to permit adjustment of the luminaire to a vertical position. The company states that this development makes it possible to adjust the unit to compensate for bracket



"Plumbizer" used in hanging pendant type luminaires. **Union Metal Mfg. Co.**, Canton, Ohio.

arms which are not of uniform curvature. The Plumbizer housing and adjusting nut, which holds the pipe nipple supporting the luminaire, are of malleable iron. Adjustment is accomplished by three cone-pointed setscrews through center of housing. A sponge rubber gasket inside the housing it said to make it insect and water proof.

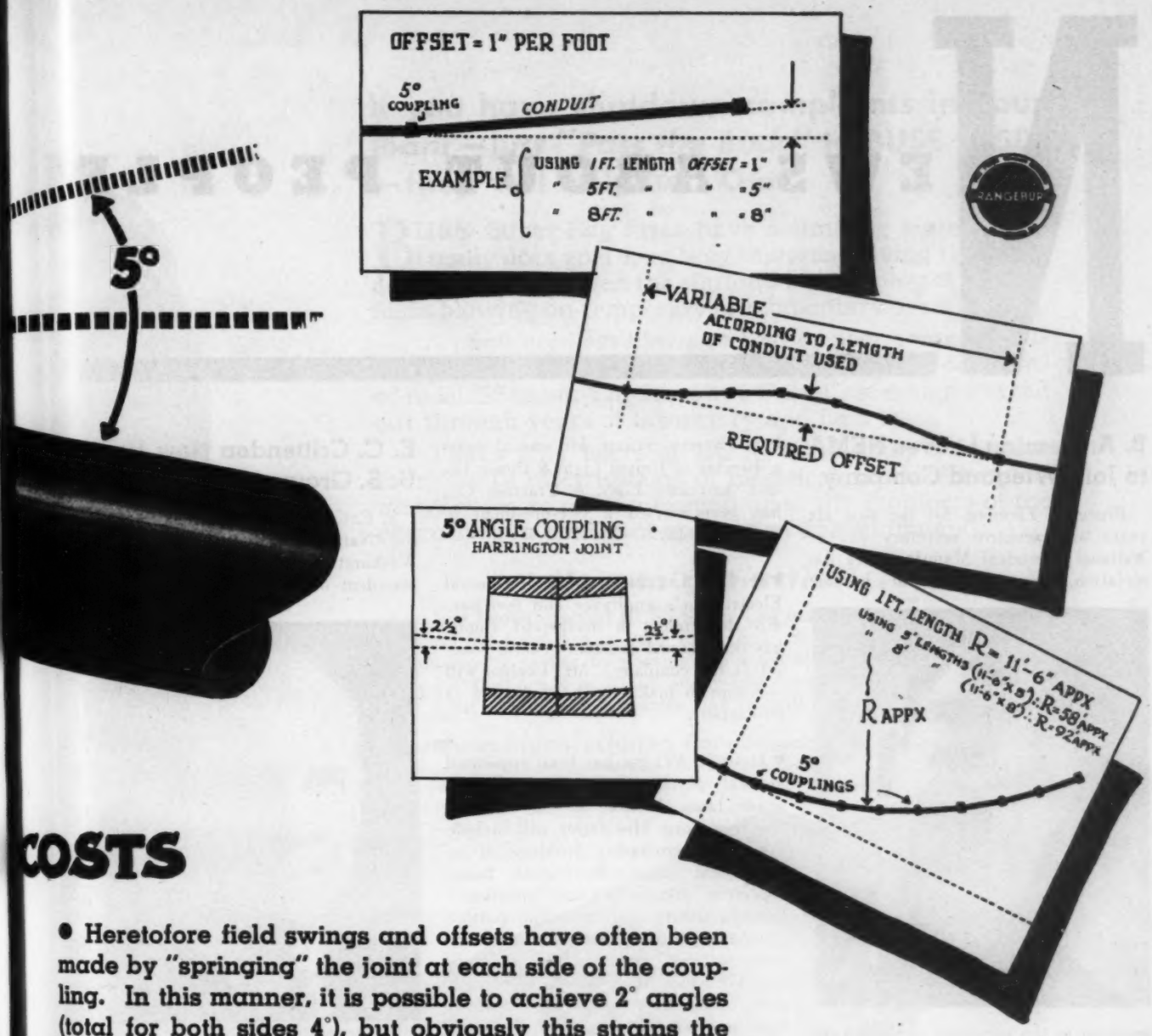
•

TECHNICAL LITERATURE

SILVER BRAZING ALLOYS—28-page booklet entitled "Silver Brazing Alloys in the Marine Field" gives charts, drawings, pictures and descriptive material for the use of silver alloys for joining metals. Should be of interest to those who join ferrous or non-ferrous metals, since the principles of brazing considered in connection with marine work apply with little or no variation to any work where low temperature silver brazing alloys are to be used. Copies may be obtained from Handy & Harman, 82 Fulton St., New York, N. Y.

APPLICATION DATA—Presents "finger-tip," briefly summarized data relating to the application of B & W Croloys and other tubular material for high temperature service. Data are given on fifteen different materials representing a complete range for almost any high-temperature tube application. Technical Data Card No. 6 may be obtained from the Babcock & Wilcox Tube Co., 19 Rector St., New York, N. Y.

ADEQUATE WIRING FOR INDUSTRY—A 40-page manual of modern methods and materials to aid the electrical contractor, the power salesman and the plant engineer in the analysis of industrial wiring systems; to assist them in making practical suggestions for worth-while improvements. Fully illustrated with photographs, schematic diagrams. Information is given to help in determining the adequacy of any industrial wiring system. Tabulated data give the necessary information. Prepared by General Electric Co., appliance and merchandise department, Bridgeport, Conn.


OFFSET = 1" PER FOOT
5° COUPLING
CONDUIT
EXAMPLE
USING 1 FT. LENGTH OFFSET = 1"
" 5 FT. " " = 5"
" 8 FT. " " = 8"
5°
VARIABLE
ACCORDING TO LENGTH OF CONDUIT USED
REQUIRED OFFSET
5° ANGLE COUPLING
HARRINGTON JOINT
2½°
2½°
USING 1 FT. LENGTH R = 11'-6" APPX
USING 5' LENGTHS (11'-6" x 5') ∴ R = 58' APPX
" 8' " (11'-6" x 8') ∴ R = 92' APPX
R APPX
5° COUPLINGS

COSTS

• Heretofore field swings and offsets have often been made by "springing" the joint at each side of the coupling. In this manner, it is possible to achieve 2° angles (total for both sides 4°), but obviously this strains the coupling; leaky joints often result. Whenever it is possible to foresee conditions that require offsetting, most engineers provide special bends and offsets in order to maintain standards of raceway construction.

• Now, by providing a relatively small number of the New "Orangeburg" 5° Angle Couplings to go out "on the job", the man in the field can meet conditions as they arise and still maintain highest quality standards.

• The 5° Angle Couplings are plainly marked with an orange stripe on the inside radius, thereby avoiding confusion with regular straight couplings and also indicating the "cock" of the 5° Angle at a glance.

Sales Agent—Distributors

GRAYBAR ELECTRIC COMPANY INC.

GENERAL ELECTRIC SUPPLY CORP.

•

MADE AT ORANGEBURG, NEW YORK BY THE FIBRE CONDUIT COMPANY 292 MADISON AVE. NEW YORK CITY

tandard for installation *with* concrete encasement

NCRETE for installation *without* concrete encasement

NEWS ABOUT PEOPLE

B. A. Fleming Leaves NEMA to Join Wiegand Company

Bruce A. Fleming, for the past six years an executive secretary of the National Electrical Manufacturers Association, has resigned to become

assistant to the president of the Edwin L. Wiegand Co., Pittsburgh, Pa., manufacturer of Chromalox heating units for electric ranges and industrial uses. Mr. Fleming has been active in sales promotion and in installment financing relating to appliance sales. He has served as branch manager for the Timken Roller Bearing Co., vice-president of the General Contracts Purchase Corp. and went to NEMA from the merchandise department of the General Electric Co. at Bridgeport, Conn.

At NEMA he has directed the recent national promotional campaigns on electric ranges, water heaters and refrigerators and has been active in the executive affairs of the Modern Kitchen Bureau and the Commercial Electric Cooking Council.

Eugene Vinet, an electrical engineer well known in the utility field and for the past ten years with the Edison General Electric Appliance Co., Inc., Chicago, takes over Mr. Fleming's work in NEMA.

▶ R. GILMAN SMITH, for several years a director of United Light & Power Co. and American Light & Traction Co., has been elected a vice-president of each company.

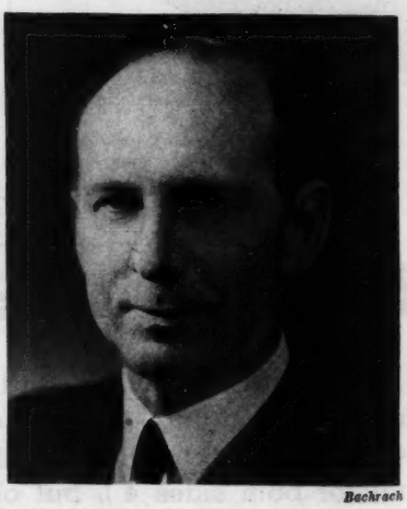
▶ RAY H. LUEBBE, counsel of General Electric Co.'s appliance and merchandise department in Bridgeport, Conn., has been named assistant general counsel of the company. Mr. Luebbe will continue to make his headquarters in Bridgeport.

▶ JOHN R. FULLER has been appointed general purchasing manager of Hygrade lamp division of the Hygrade Sylvania Corp. His duties will include the major purchasing problems of incandescent lamp, fluorescent lamp, "spectron" sign tubing and "miralume" lighting fixture activities. The routine purchasing for incandescent and fluorescent lamps and spectron sign tubing, for which E. S. Upton is responsible, and for "miralumes," which come under the direction of I. R. Schaller, will remain unchanged.

JOSEPH F. PORTER, Jr., vice-president of Kansas City Power & Light Co., who was recently appointed chairman of the Commercial Electric Cooking Council

E. C. Crittenden New Head U. S. Group of I.E.C.

E. C. Crittenden, assistant director of the National Bureau of Standards, Washington, D. C., has been elected president of the U. S. National Com-



Bachrach

mittee of the International Electrotechnical Commission. Mr. Crittenden succeeds Dr. C. H. Sharp, new honorary president.

Mr. Crittenden has been a member of the electrical standards committee of the American Standards Association and the U. S. National Committee since 1931, and in addition to his work on several of the technical committees of the A.S.A. he has represented the National Bureau of Standards on the A.S.A. standards council since 1924.

He is a past-president of the Illuminating Engineering Society and for many years has been chairman of the society's committee on nomenclature and standards.

•

▶ E. C. BRODE has been appointed merchandise manager for the central district of the Westinghouse Electric Supply Co. with headquarters at Detroit. He will be in charge of operations for

If you have shutdown complaints in Your Plant—just *"Pass the Buck"* to BUSS FUSES —they will Help You Out!

BUSS Super-Lag fuses have a time-lag feature that really does go a long way towards solving the shutdown problem—when the shutdowns are being caused by fuses blowing on temporary or momentary overcurrents.

. . . and needless blows caused by poor contact heating within the fuse itself have practically been eliminated in BUSS Super-Lag fuses by a Fuse-Case design worked out through years of laboratory and field tests.

That's why users of BUSS fuses enjoy a freedom from costly interruptions of electrical service that formerly were so often a burden upon the shoulders of the executives in charge of production or maintenance.

How to get action . . .

Just knowing about BUSS Super-Lag fuses doesn't save any money —unless the fuses are in your fuse clips. So why not get action that means money saving by passing the word along that from now on all fuses installed are to be BUSS Super-Lag fuses?

Your electrical wholesaler has or will get BUSS fuses for you.

Bussmann Manufacturing Co. • University and Jefferson • **St. Louis**

Division of McGraw Electric Company

his department in Ohio and Michigan. Mr. Brode has been connected with Westinghouse since 1926.

•

Alfred H. Nicoll Elected Graybar Vice-President

Alfred H. Nicoll has been elected to the office of vice-president of the Graybar Electric Co. in New York. Since last November he has served as assistant to

the president and for the eight years previous to that as district manager of Graybar's San Francisco territory. He became associated with the company in 1911.

The electrical industry, particularly on the West Coast, is familiar with Mr. Nicoll's ability not only in a business sense but also through his activities in many electrical associations and kindred organizations. In 1927 he was president of the San Francisco Electrical League and in later years headed up various committees of the Pacific Coast Electrical Association. He also devoted considerable time to the Pacific Division of the National Electrical Wholesaler's Association and in 1933 was elected chairman of the division.

•

▶ PROF. EMORY L. CHAFFEE has been appointed director of the Cruft Memorial Laboratory at Harvard University, Cambridge, Mass., succeeding Dr. G. W. Pierce, retiring head of the organization. Prof. Chaffee was graduated from the Massachusetts Institute of Technology in 1907 and attained his Ph.D. at Harvard in 1911. He was an instructor in electrical engineering for four years at Harvard and since then has been on the staff of the physics department, holding the chair of full professor from 1926 to 1935, and since 1935 that of Gordon McKay professor of physics and communication engineering. The Cruft laboratory is the major center of communication engineering research and instruction at the university.

▶ FRED W. HOLZ, JR., will join the Ashton B. Collins organization, Birmingham, Ala., in the expansion of the "Reddy Kilowatt" program. Mr. Holz has been connected with the electrical industry for a number of years, first with the old National Electric Light Association, and then the Edison Electric Institute, serving on the headquarters staff in New York, first in the engineering department and then for the past several years in the commercial department directly under C. E. Greenwood, commercial director. Among his other duties, Mr. Holz was secretary of the Commercial Electric Cooking Council. He will assume his new duties May 15.

▶ FRANK A. KETCHAM, president of the Graybar Electric Co., was the guest of honor at a luncheon given by the executives of the company in New York on April 24 to observe his fortieth year with the organization. Mr. Ketcham commenced his career with Graybar, formerly the supply department of the Western Electric Co., in 1900, in the advertising department in Chicago. Advancing through various positions, he was transferred to New York in 1918 and received the appointment of general sales manager. Five years later he was appointed general manager of the supply department, and when in 1926 that department became the Graybar Electric Co. Mr. Ketcham was elected executive vice-president of the new organization and within three years he became president.

OBITUARY

▶ ALBERT H. FORD, retired utility manager and a pioneer in the development of utilities in the South, died April 19 in St. Petersburg, Fla. He was 86 years of age. Mr. Ford was born in New York and began his business career in New Orleans, where he became general manager of the Street Railway & Power Co. and directed the installation of the city's first street railway. In 1902 he joined the New York engineering firm of Ford, Bacon & Davis, but not long afterward became president of the American Cities Power & Light Co., operating properties in Southern cities. He went to Birmingham, Ala., in 1906 as president of the Birmingham Railway, Light & Power Co., and in 1914 he became vice-president and general manager of the Cumberland County Power & Light Co., Portland, Me., where he served for many years. On his retirement in 1935 he was connected with the Brooklyn Edison Co. Since then he had lived in Florida.

Walter S. Rugg

Walter S. Rugg, retired vice-president of the Westinghouse Electric & Manufacturing Co. and widely known throughout the electrical industry as an engineering and sales executive, died April 25 in New York, after a heart attack. He was 74 years old.

Mr. Rugg had engaged in almost every phase of electrical development, combining the exact and technical training of an engineer with the broad experience of a commercial executive.

A native of Brodhead, Wis., Mr. Rugg began his electrical career as a student engineer at Westinghouse in 1892, following graduation from Cornell University. Three years later he went to the Chicago office as district engineer, later transferring to the sales force. Subsequently he served as manager of

Underwood & Underwood

the New York office, as manager of the railway department in East Pittsburgh, and then of the marine department.

In 1922 he became general sales manager of the company and in 1925 was elected vice-president. While holding that office he was in charge of sales and engineering activities of the company.

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▶ CHARLES A. BAY, sales and consulting engineer for the Metropolitan Device Corp., Brooklyn, N. Y., died April 23, after a heart attack, at his home in Morristown, N. J. He was 52 years old. Mr. Bay was associated with several companies as a mechanical and electrical engineer before he joined the Metropolitan Device Corp.

▶ JOHN R. MCGINN, JR., 40, supervisor of production at the West Lynn works of the General Electric Co., died at Boston, Mass., April 3. He was graduated from the company's apprentice school in 1915 and became supervisor in 1934.

SEE all around THE PROBLEM

the big thing in Condenser Tubes is the name Revere

BY PRESCRIPTION

℞ Choice of eleven different alloy compositions to meet your special operating conditions.

HOMOGENIZED

Tubes are produced by extrusion followed by cold working. The extrusion operation provides clean, dense, sound metal free from defects and impurities.

PRECISION PROVED

Rigid inspection at every step of production maintains Revere condenser tubes in conformity with rigid mechanical, metallurgical and chemical specifications.

RIGHT NEXT DOOR

Six Revere mills and coast to coast sales offices give you rapid, personalized service.

REVERE COPPER AND BRASS INCORPORATED

230 PARK AVENUE • NEW YORK, N. Y.

MILLS: BALTIMORE, MD. • CHICAGO, ILL. • DETROIT, MICH. • NEW BEDFORD, MASS. • ROME, N.Y. • TAUNTON, MASS.

MANUFACTURING - MARKETS

Issue Capital Plan for General Cable

A special stockholders' meeting of General Cable Corp. has been called for May 23 to vote on a plan of recapitalization, requiring approval of two-thirds of each class of stock.

Under the plan recommended by the board of directors the corporation's 150,000 shares of 7 per cent cumulative $100 par value preferred stock will be changed into 150,000 shares of 4½ per cent cumulative preferred stock and 1,200,000 shares of common stock, on the basis of eight shares of common for each share of preferred stock outstanding.

The 306,689 shares of class A stock outstanding on April 1 will be changed into 1,226,756 shares of common stock on the basis of four shares of common stock for each share of class A stock.

At present there are outstanding 671,858 shares of common out of an authorized 3,000,000 shares. Under the plan the total authorized shares of common shall be increased to 3,336,132 by changing the 336,132 shares of class A stock which are now authorized but unissued into a like number of shares of authorized common stock.

•

Metal Industrial Reflector Sales

Sales of metal industrial lighting reflectors in 1939 reported to RLM Standards Institute by seven of the twelve known manufacturers of this type of product were just over one million units. These statistics, which have been estimated to represent in excess of 70 per cent of the total sales of the industry, break down into 986,084 incandescent lamp units and 14,301 mercury units. Details of production by types are given in the accompanying table.

Invest $32,000,000 In Laundering Units

Household washer shipments for January-March totaled 411,276, or 4.78 per cent above 392,519 in the same period of 1939, according to industry totals reported by J. R. Bohnen, executive secretary-treasurer of the American Washer and Ironer Manufacturer's Association. It was the highest first quarter since 1937.

Washer shipments in March totaled 149,730, or 1.96 per cent below the March, 1939, figure of 152,725, and an increase over the preceding month's 142,318, second highest February in the industry's history. It was the first month since October, 1938, to show a decrease from the comparison month. March ironer shipments were 12,048, against 13,431 last year, a 10.30 per cent decrease.

"Brightest in the industry picture is the fact that the trade generally is ordering out washers of higher price

1939 Metal Industrial Lighting Reflector Sales

Reflectors	Incandescent Units								Mercury Units		
	60-W. and Under	75-W.	100-W.	150-W.	200-W and 500-W. Med.	300-Mogul to 500-W.	750-W and Over	Total	250-W. and Under	400-W.	Total
Glassteel Diffusers	.....	.....	.....	.....	15,904	20,525	6,574	43,003	190	2,708	2,898
RLM Standard Dome	.....	4,374	49,396	59,410	95,170	64,378	4,925	277,653	.....	.....	.....
RLM Deep Bowl	.....	5,430	9,633	410	5,231	1,444	910	23,058	.....	.....	.....
RLM Symmetrical Angle	.....	3,014	10,808	13,271	1,770	3,953	920	33,736	4	.....	4
RLM Silvered Bowl Diffuser	.....	.....	.....	.....	.....	6,532	.....	6,532	.....	.....	.....
Non-Labeled Stand. Dome	839	39	20,147	26,365	22,423	5,757	118	75,688	301	3,015	3,316
Non-Labeled Deep Bowl	4,728	3,180	2,249	1,457	564	1,667	477	14,322	.....	47	47
Angle Sign Refls. and Non-Labeled Angle Reflectors	12,179	3,372	36,016	42,602	23,521	8,437	2,195	128,322	54	382	436
Non-Labeled Shallow Dome, Standard Type	15,403	26,406	78,001	48,834	22,498	5,249	.....	196,391	.....	.....	.....
Non-Labeled Shallow Dome, Secondary Type	18,853	2,015	72,759	42,067	8,452	32	.....	144,178	.....	.....	.....
Vapor Proof	159	11	4,728	8,021	10,982	3,828	.....	27,729	38	.....	38
High Bay Aluminum	.....	.....	50	80	41	6,892	8,156	15,219	61	4,678	4,739
Combinations Mercury and Mazda	.....	.....	.....	.....	.....	159	94	253	748	2,047	2,795
Totals	52,161	47,841	283,787	242,517	206,556	128,853	24,369	986,084	1,396	12,877	14,301

AUTOMATIC RECLOSING CIRCUIT BREAKERS . . .

for GENERAL PURPOSE FEEDER PROTECTION

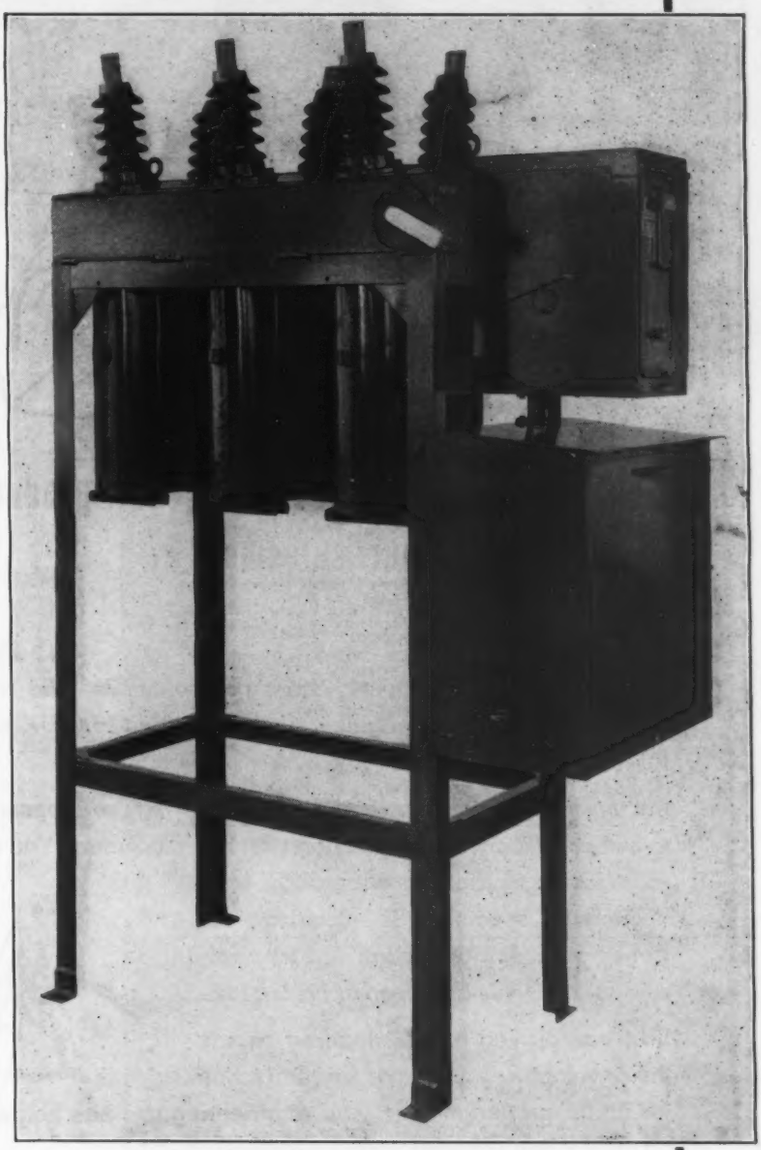
●

Endowed with every essential feature that makes for efficient operation, AUTOMATIC SWITCH COMPANY products are *reasonable* as to *first cost* and incur little *installation* expense—every unit is shipped complete and ready for use. Specialized design makes for low maintenance. Add to these money-saving features the high reliability of AUTOMATIC products, under widely varying service conditions, and you get the sum and total of *why* the AUTOMATIC SWITCH COMPANY offers you superior products per dollar invested.

●

AS AN EXAMPLE, THE AUTOMATIC RECLOSING CIRCUIT BREAKER . . .

This unit is especially designed to eliminate costly and complicated reclosing relays, rectifiers and other devices requiring special knowledge and frequent attention. Their flexibility permits ready application to problems of an unusual nature. They're suitable for portable substations. Special heights to meet local conditions, remote and supervisory control features are available at small additional cost and without delay in delivery.



TYPICAL 15 KV BREAKER WITH INSTRUMENT CABINET

COMPLETE INFORMATION ON AUTOMATIC BREAKERS UP TO 100,000 KVA AT 15,000 VOLTS WILL BE MAILED PROMPTLY ON REQUEST — WRITE TODAY!

AUTOMATIC SWITCH COMPANY

DETROIT **14603 WYOMING AVE.** **MICHIGAN**

Now Gentlemen, Please!

We understand you're selling our product to our salesmen!

What is this, anyway?

We're hearing continuously from our salesmen who tell us of new uses, new engineering suggestions for LUX extinguishers.

But *these suggestions are coming from you!* You're supposed to be our customers. But you don't act like customers. You're more like a staff of consulting LUX engineers who specialize in electrical and power plant fire protection . . . who constantly advise us and keep us on our toes.

LUX has played a vital, leading part in the development of proper fire protection for utility properties. Yet *your* engineering aid has helped us take many forward steps.

In return we promise you this — LUX engineering will continue to maintain LUX equipment as your finest safeguard against crippling fires . . . your safest insurance of steady, uninterrupted delivery of power.

LUX
SNUFFS OUT FIRE

Walter Kidde & Company, Inc.
528 West Street • Bloomfield, New Jersey

levels," Secretary Bohnen said. The average retail price of all washers shipped in the quarter was $72.31, against $69.09 for the first quarter of 1939. "There is so little lag between factory shipments and retail sales that this means women invested $32,000,000 in laundering equipment, ironers included, in the first quarter of 1940."

•

Manufacturers Issue Earnings Reports

Line Material Co., South Milwaukee, Wis., in its annual report to stockholders showed a profit from operations last year of $907,751, against $595,189 the previous year. Net sales for 1939 were $9,205,000, a 27.2 per cent increase over 1938. According to W. D. Kyle, president of the company, shipments for the first quarter of 1940 were slightly greater than for the corresponding 1939 period.

Among the other manufacturing companies recently issuing reports on operations are the following:

OKONITE CO. — For 1939, net loss, $36,258, compared with $205,483 loss in 1938.

MINNEAPOLIS-HONEYWELL REGULATOR — And subsidiaries, March quarter, net income, $294,703, compared with $67,289 last year.

POLAROID—And subsidiaries, 1939, net income, $27,947, equal to 58 cents each on 169,742 capital shares, compared with net loss of $5,687 last year.

•

Air Conditioning Unit for Small Homes Offered

A broad manufacturing and sales program to provide heating and air conditioning equipment at low cost for homes in the $2,000 to $9,000 class, has been announced by the Norge Heating Division of the Borg-Warner Corporation. Four new units are expected to be in full production before the first of June, according to Vice-President Howard E. Blood.

The new units range in size from a small installation to be made below the floor requiring no basement, up to a completely automatic full-sized pressure type oil furnace with electric ignition, air filter and humidifier. All are of the oil-burning, warm air type and an alternate model in the larger size is designed to burn gas.

New York Metal Prices

	April 30, '40 Cents per Pound	April 21, '40 Cents per Pound
Copper, electrolytic	11.25*	11.25*
Lead, A. S. & R. price	5.10	5.10
Antimony	14.00	14.00
Nickel, Ingot	35.00	35.00
Zinc, Spot	6.14	6.14
Tin, Straits	47.50	47.375
Aluminum, 99 per cent	19.00	19.00

*Delivered Connecticut Valley.

Here's the Result

A clamp of special length with high ultimate strength and very high slip strength.

Arcing horns; 36 inches long, ¼ x 2½ inch, with special tips.

Special heavy duty, horn supporting fitting.

Extraordinary corona performance.

More than a Forging ...A Service

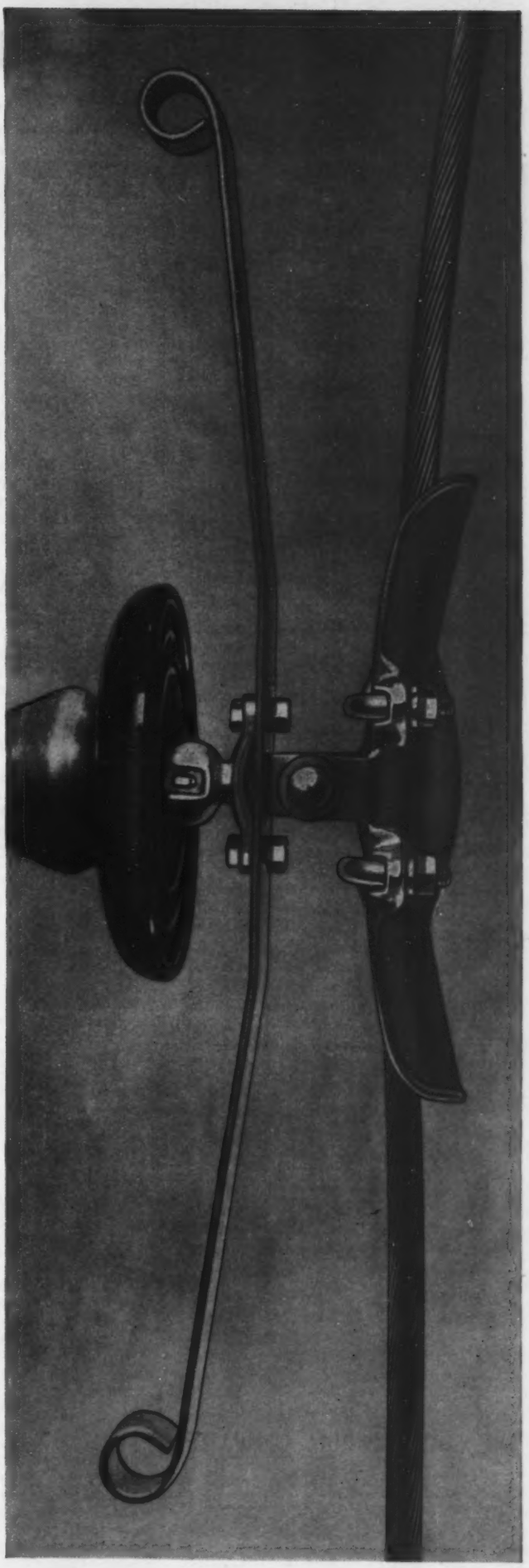
Perhaps it appeared a bit odd to see the illustration of this clamp running vertically on the page.

However, we wanted the engineers to examine it closely, and to do so we utilized all the space possible.

Here is just another example of the service at the disposal of the buyer of BTC hi-line hardware.

BTC cooperates with the utility engineer and insulator manufacturer in the designing and production of difficult hardware. Play safe, use the service of men who know forgings as well as the requirements of hi-line hardware.

THE BREWER-TITCHENER CORPORATION
Cortland, New York



Globar
REG. U. S. PAT. OFF.

A monthly meeting place for news and views about High Temperature Electric Heat

MORE about some of the unique qualities that are making "Globar" news in the field of high temperature heating today:

"Globar" is the only electric heating element we know of that has a dual temperature resistance characteristic. This can be explained in this way:

With increasing temperature, up to about 1400°F. (750°C.) the resistance decreases, that is to say, the elements have a negative temperature coefficient of resistance; from 1400°F. (750°C.) to about 3000°F. (1649°C.) the resistance of the elements increases with increasing temperature, in other words, within this range, the element has a positive temperature coefficient of resistance. From this it will be observed that Globar Brand Heating Elements cause no heavy line surges because the current is sub-normal upon closing the circuit and gradually increases until the element reaches incipient cherry red, 1400°F. (750°C.), after which the current is automatically stabilized, due to the reversal from negative to positive in its temperature resistance characteristics.

Another curious fact about these elements is that their physical dimensions remain practically unaltered throughout their useful life and, since no distillation or sublimation products are released, the consequent absence of fumes, gases and smoke improve working conditions wherever the elements are used and the problem of atmosphere control in specialized furnaces is simplified through their use.

DON'T MISS next month's installment. And don't wait, either! For full information about Globar Brand Non-Metallic High Temperature Electric Heating Elements, write today.

GLOBAR DIVISION
THE CARBORUNDUM COMPANY
REG. U. S. PAT. OFF.
NIAGARA FALLS, N. Y.

[Carborundum and Globar are registered trade-marks of and indicate manufacture by The Carborundum Company]

No. 4 of a Series. We will be glad to send a reprint of the previous numbers if you so desire.

Business Reports

Reports from around the country show a preponderance of bright spots. In the general picture, price levels, wage levels, volume of current business, of backlogs and of new orders seem to be in a balanced relationship which leads to further advances. The war has given a fillip to specific industries. But with residential construction, steel output, automobile sales, department store and rural buying all running ahead of last year, the consensus is that business is headed upward rather than downward at this season of the year.

NEW YORK

The growing interest locally in the reception accorded Republican candidates for the presidency, the restoration of steel prices, the continued progress of business generally above 1939 levels, the prediction of General Motors officials that sales would gain 20 per cent in 1940 and the tendency of the popular indices, including that of the Federal Reserve Board, to hold onto 1940 gains are some of the factors contributing to the expression of better feelings toward business prospects over the next three to six months.

Appliance manufacturers point to the fact that for the fifth successive week in excess of 3,000 homes have been started under FHA inspection and mortgaging plans. In the week ended April 20 the total was 3,581 new homes. Further gains in construction in the months ahead are signaled by the large number of mortgage applications being filed. In the latest week available 4,823 applications have been approved, or 33 per cent more than last year.

So far this year construction has been started on more than 40,000 new FHA homes, compared with 36,721 last year.

Equipment manufacturers are watching the portent of higher rates for steel operations, with Pittsburgh expected to increase two points to 59 per cent and Youngstown up four points to 49 per cent.

Steel, machinery and airplanes are the major items responsible for the 31 per cent increase in exports over a year ago. In March (latest available) Department of Commerce reports exports of $352,272.000 exceeded imports by $135,540,000.

April rail freight traffic has held its gains over a year, according to preliminary reports this week from Pennsylvania R. R. Atlantic Coast Line, Union Pacific and two minor roads.

Finally industrial employment is making substantial progress, with the Secretary of Labor reporting an increase in mid-March of 1,000,000 over March, 1939.

NEW ENGLAND

Stone & Webster Engineering Corp. is to design and construct a $3,000,000 addition to the Montaup Electric Company's steam plant at Somerset, Mass., the equipment to include a 20,000-kw. top turbine unit and boiler of about 600,000 lb. per hour steam capacity. U. S. Navy has ordered about $500,000 worth of metal-clad switchgear from Westinghouse Co. for the Norfolk, Va., navy yard, Arthur L. Nelson, Boston, consulting engineer.

Edison General Electric Appliance Co. has sold a 146-kw. electric cooking assembly to the Augusta, Me., State Hospital and another group aggregating about 60 kw. to the Augusta, Me., General Hospital. Inquiries for electric ranges for restaurant service are increasing throughout this area and commercial refrigeration is receiving considerably more attention than for some time past.

The Boston *Herald-Traveler* has installed a new "news flash" illuminated sign. Constructed by the C. I. Brink, Inc., Boston, this sign has 400 ft. of fluorescent gold tubing and 800 ft. of zeon tubing and requires 15 kw. in energy. Inquiries for small turbo-generator units are being received in good volume and small motor sales are quite rampant among machine tool builders.

Massachusetts industrial activity during March showed a small seasonal increase over the February level and electrical power consumption likewise increased.

CHICAGO

In spite of the uncertainties prevalent in general business at present, inquiry reveals a rather healthy condition in the electrical industry. First quarter operations were highly satisfactory and during the month of April the margin of increase over last year has been maintained. Orders for new equipment are holding steady and, in some instances, showing moderate gains over last month.

Utility buying has, of course, been an important factor in helping manufacturers maintain a substantial volume. Industrial activity, which declined rather rapidly from the peak last autumn, became much steadier during the past month. Inquiries for electrical equipment are getting more and more frequent from that source and represent considerable diversity of apparatus.

From a recent survey conducted among wholesalers of home-furnishing lines in the Merchandise Mart the sales volume of electric appliances was 26 per cent above a year ago.

PACIFIC COAST

Electrical merchandise is running somewhat below last year's sales throughout the seven Western states, though the increase is not so marked as in other classes of business. In fact, despite apprehension as to Washington's attitude toward business and to war spread, electrical sales in all branches continue fair to good, and natural factors, such as crops, are excellent.

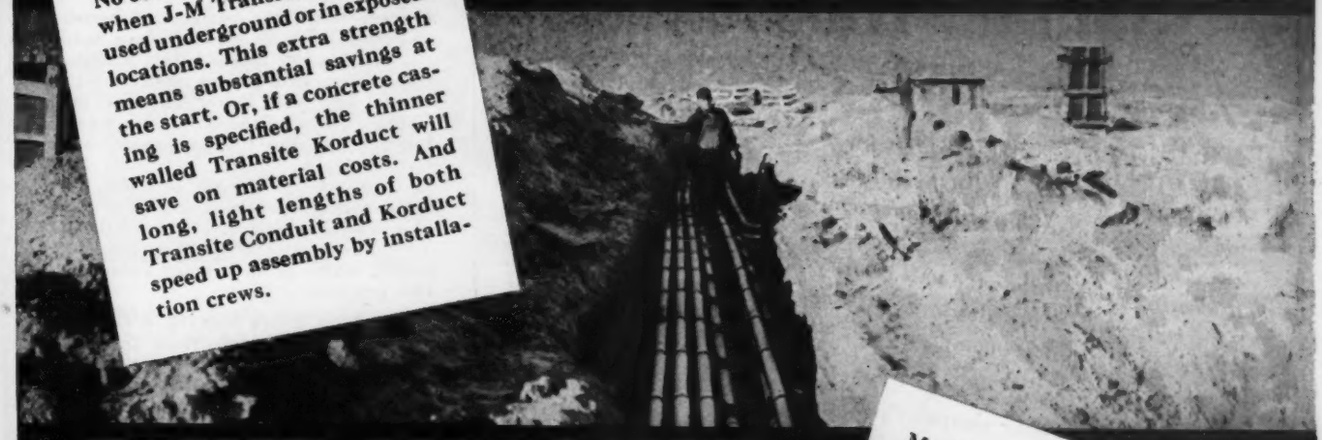
Industrial business, both present and potential, is very good. Recent typical sales to various plants have included twelve 25-hp. geared motors, value $7,500, for an oil plant; 450 fractional-horsepower motors, value $10,000, for pressure pumps; $7,500 welding equipment for Bay shipyards; a four-unit motor-generator set, value $8,000, for a building paper manufacturer; a $5,000 storage battery locomotive for a Nevada gold mine; $1,500 speed reducer equipment for a lumber mill; $6,000 dredger equipment for Alaska; two 1,500-kva. transformers, value $12,000, for a California dredger; $12,000 for two electric furnaces for a tractor manufacturer, and $11,000 oil circuit breakers for Hawaiian plantations.

Every outdoor fixture, spot and flood, at San Francisco's exposition has been relamped for its May 25 opening and the outdoor illumination, its 1939 outstanding feature, has been largely recast in a higher color key.

WHY NOT USE DUCTS THAT...

COST LESS TO INSTALL

No concrete envelope is needed when J-M Transite Conduit is used underground or in exposed locations. This extra strength means substantial savings at the start. Or, if a concrete casing is specified, the thinner walled Transite Korduct will save on material costs. And long, light lengths of both Transite Conduit and Korduct speed up assembly by installation crews.



RESIST CORROSION

Made of asbestos and cement, J-M Transite Ducts can take plenty of severe punishment from corrosive soils, weather, smoke or acid fumes. They are absolutely incombustible, have exceptionally high resistance to flame and arc, and do not contribute to gas formation when burnouts occur. These ducts will not rot or decay—reduce maintenance costs wherever they are used.

STAY SMOOTH INSIDE

The interior surface of Transite Ducts is unusually smooth, and it *stays* smooth. Joints are tight and snug. Long cable pulls may be made without injury to the sheath . . . cables can be easily removed.

•

There are many other reasons why Transite Ducts assure lower distribution costs. For complete information, write for Data Sheet Manual DS-410. Johns-Manville, 22 E. 40th St., New York City.

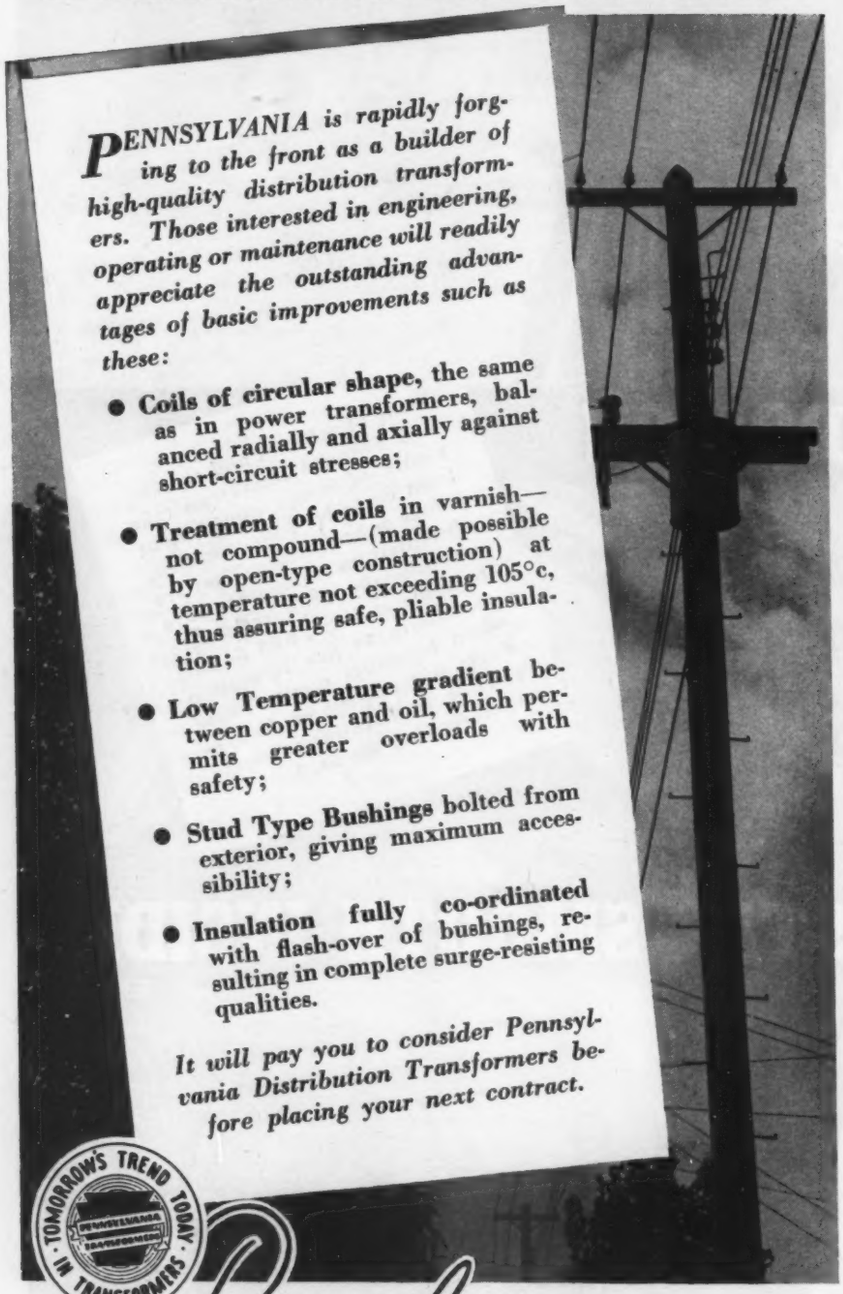
JOHNS-MANVILLE JM PRODUCTS

Johns-Manville TRANSITE DUCTS

FOR LOW-COST ELECTRICAL DISTRIBUTION

Before you buy—investigate

PENNSYLVANIA
Distribution Transformers



PENNSYLVANIA is rapidly forging to the front as a builder of high-quality distribution transformers. Those interested in engineering, operating or maintenance will readily appreciate the outstanding advantages of basic improvements such as these:

- **Coils of circular shape,** the same as in power transformers, balanced radially and axially against short-circuit stresses;
- **Treatment of coils** in varnish—not compound—(made possible by open-type construction) at temperature not exceeding 105°c, thus assuring safe, pliable insulation;
- **Low Temperature gradient** between copper and oil, which permits greater overloads with safety;
- **Stud Type Bushings** bolted from exterior, giving maximum accessibility;
- **Insulation fully co-ordinated** with flash-over of bushings, resulting in complete surge-resisting qualities.

It will pay you to consider Pennsylvania Distribution Transformers before placing your next contract.

TOMORROW'S TREND TODAY IN TRANSFORMERS

Pennsylvania
TRANSFORMER COMPANY

1701 ISLAND AVENUE, N. S., PITTSBURGH, PA.

Recent Rate Changes

CENTRAL NEW YORK POWER CORP. and the New York Power & Light Corp. have filed revised schedules with the state Public Service Commission calling for reductions in residential electric rates. The changes are estimated to save residential consumers $191,800 annually in various districts of the companies in Oneida, Fulton, Herkimer, Jefferson, Lewis, St. Lawrence, Franklin and Madison counties. The changes which the commission permitted to become effective May 1 reduce residential rates in the Rome, Utica, Watertown, Ogdensburg and Malone districts of the Central New York Power Corp. and in the Oneida district of the New York Power & Light Corp. The total reduction in the revenue of the Central New York Power Corp. amounts to $166,400 annually, which is an average reduction of 7.9 per cent. The total reduction in revenue of the New York Power & Light Corp. is $25,400 annually, which is an average reduction of 10.3 per cent.

NEW YORK STATE ELECTRIC & GAS CORP. has filed general reductions in electric rates with the state Public Service Commission which are estimated to save consumers in the Liberty and Walden districts of the company a total of $81,300 annually. The changes in rates will save consumers in the Liberty district a total of $78,600 and will save consumers in the Walden district a total of $6,000. Of the $78,600 annual reduction in the Liberty district residential customers will save $27,000 a year, general commercial consumers will save $22,700 a year, seasonal customers will save $16,000 annually, small power users will save $7,800 a year and large power users will save $1,800 a year. Of the $6,000 annual reduction in the Walden district residential customers will save $2,200 annually, general commercial consumers will save $2,600 annually and power customers will save $1,200 annually.

PORTLAND GENERAL ELECTRIC CO. and Northwestern Electric Co. have filed with the Oregon Public Utilities Commissioner a reduction in electric rates of $106,000 affecting 27 large industrial power users. The average rate reduction is 20 per cent of monthly bills. Twenty of the customers affected and about $75,000 of the reduction are Portland General Electric users, and seven customers and $31,000 in savings are Northwestern users. The reduction is applicable to industrial power customers having measured demands of not less than 375 kw.

MOUNTAIN STATES POWER CO. has reduced its rates $180,600 annually. The reductions affect the Willamette Valley, Coos Bay and Tillamook areas. Both residential and commercial rates are involved in the reduction.

KENTUCKY-TENNESSEE LIGHT & POWER CO.'s revised rates and charges for electricity have been accepted for filing by the Kentucky Public Service Commission. The revision results in an estimated decrease in the revenues of the company in the amount of $76,660. Of this amount residential users will receive a reduction of $28,610, commercial users a reduction of $39,890 and municipal street lighting users, $8,160. These revised rates became effective on bills rendered subsequent to May 1.

GLENWOOD LIGHT & WATER CO., Glenwood Springs, Colo., has been ordered by the state Public Utilities Commission to reduce its electric rates 5 per cent. The reduction order, according to E. E. Wheeler, chairman of the state commission, will

ARRIVING TIME: 1 HOUR: 35 MINUTES!

1. "AT 11:50 A.M. recently we received an order for 10 plates and one angle to be cut. Customer specified material must be in Jersey City at 1:30 P.M. the same day."

2. "THE MATERIAL was trucked from our Newark Warehouse to Jersey City—10 miles distant —arriving at 1:25; one hour and 35 minutes after the order was placed."

THOUSANDS of customers have discovered that when an emergency arises Scully is always ready to meet it with service to match the occasion. And our customers have also found out that regular orders receive the same prompt, courteous attention. Each of our 8 warehouses operates on the principle that our customers always want immediate delivery—we hurry whether you ask us or not.

The next time you order steel or steel products, why not call Scully and discover why "Scully Service" is famous the country over? And ask for a free copy of our handy 1940 Stock List and Reference Book.

The Mark of Quality — USS Scully Service — *The Mark of Service*

We have a complete stock of ELECTRICAL SHEETS in our Chicago warehouse

SCULLY STEEL PRODUCTS COMPANY

Distributors of Steel, Steel Products, Copper and Brass

Warehouses at CHICAGO · NEWARK, N. J. · ST. LOUIS · BOSTON
ST. PAUL-MINNEAPOLIS · CLEVELAND · PITTSBURGH · BALTIMORE

UNITED STATES STEEL

POWER MAP

A time-saving service for busy individuals and organizations

Two years painstaking investigation makes available a map showing electric generating and transmitting facilities in the Western States, complete to January 1, 1940. Not since 1923 has such a service been offered. The map makes it possible to see the new electrical set-up in the Far West spread out before you —at a glance.

THE MAP SHOWS:

Type, capacity of plants
Voltage, capacity of lines
Type, size of conductors
Receiving station capacities
Interconnection capacities

52x66 in. — 1 in. = 22 mi.
Prepared by Frank I. Towle Jr.

THE MAP COVERS:

Arizona	**Nevada**
California	**Oregon**
Idaho	**Utah**
Montana	**Washington**

and parts of British Columbia and Wyoming, and enlargements of sub-transmission facilities in nine city areas.

Those who need facts quickly—all those concerned with planning, building, regulating, selling to or studying electric systems in the Pacific area will find this map invaluable.

Write for details

McGraw-Hill Co. of Calif.
68 Post St., San Francisco

save Glenwood Springs consumers $3,000 a year.

OHIO PUBLIC UTILITIES COMMISSION has authorized the filing of new rural residential and commercial tariffs by New Madison Lighting Co., Greenville Electric Light & Power Co., Eaton Lighting Co., Buckeye Light & Power Co., Brookville & Lewisburg Lighting Co. and Bradford & Gettsburg Electric Light & Power Co. The new rates became effective May 1. The residential schedule follows—From: first 40 kw.-hr. per month at 9 cents per kilowatt-hour; next 40 kw. at 6 cents per kilowatt-hour, excess 3 cents per kilowatt-hour; To: first 25 kw.-hr. per month 8½ cents per kilowatt-hour; next 25 kw.-hr., 7 cents per kilowatt-hour; next 150 kw.-hr. 3 cents per kilowatt-hour; excess 2½ cents per kilowatt-hour. Commercial—From: first 50 kw.-hr. per month, 9 cents per kilowatt-hour; next 50 kw.-hr., 6 cents per kilowatt-hour; next 100 kw.-hr., 5 cents per kilowatt-hour; next 800 kw.-hr., 4 cents per kilowatt-hour; excess 3½ cents per kilowatt-hour; To: first 40 kw.-hr. per month at 8½ cents per kilowatt-hour; next 40 kw.-hr., 6½ per kilowatt-hour; next 120 kw.-hr. 5 cents per kilowatt-hour; next 200 kw.-hr. 3½ cents per kilowatt-hour, excess, 3 cents per kilowatt-hour.

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Municipal Plants

NEW LONDON, MO.—Voters on June 1 will again be called upon to pass on a proposed $29,500 bond issue to finance the construction of a municipal electric distribution system. Power would be obtained from the Hannibal, Mo., municipal plant. At previous elections the project obtained a majority of the vote cast, but not sufficient to attain the constitutional two-thirds majority still required in Missouri.

ST. CHARLES, MO.—By unanimous vote of its eight members the St. Charles City Council has authorized a $600,000 bond election for the construction of a municipally owned electric generating plant and for construction or purchasing of an electric distribution system. The Council set May 4 as the date for the special election. A two-thirds vote in favor of the project is necessary for adoption. Union Electric Co. serves the city.

•

Westinghouse Forms New Vacuum Cleaner Section

Creation of a separate vacuum cleaner section in the Westinghouse appliance department to co-ordinate the company's intensified activity on that appliance has been announced by Frank R. Kohnstamm, sales manager Westinghouse merchandising division.

Major feature of the expanded Westinghouse vacuum cleaner program is the introduction of two new models, one of them a cylinder type model, the other a combined floor cleaner and hand-operated cleaner.

George E. Wagner, formerly laundry equipment regional supervisor, has been named manager of the new vacuum cleaner section. Mr. Wagner has been associated with Westinghouse since 1937.

•

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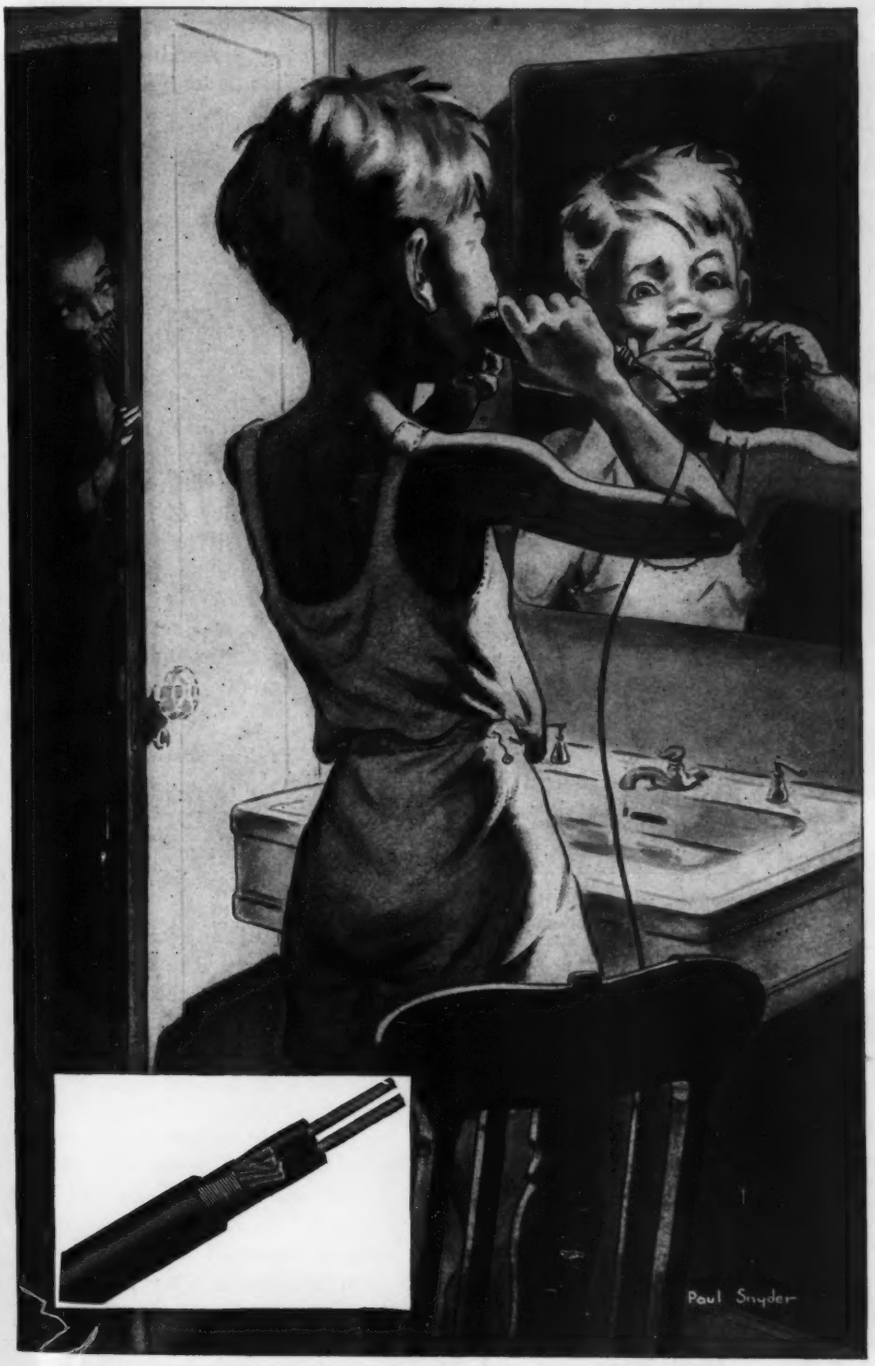

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Hot Rolled Copper Rods • Bare and Tinned Strand
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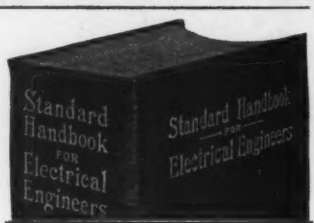

28 helpful sections

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Direct-current Generators and Motors
Converters and Rectifiers
Steam, Gas and Oil Prime Movers
Hydraulic Prime Movers
Power-plant Electrical Equipment
Power Plant Economics
Power Transmission
Power Distribution
Wiring of Buildings and Industrial Plants
Illumination
Industrial Motor Applications
Electric Heating Applications
Electric Railways
Electric Trucks and Buses
Marine Power Applications
Electrochemistry and Electrometallurgy
Batteries
Wire Telephony and Telegraphy
Radio and Carrier Communication
Electron Tubes and Electric Wave Filters
Miscellaneous Electrical Applications

Portable Kit Dramatizes Poor Wiring

[*Continued from page 49*]

and 100 ft. of No. 12 wire are actually carried and can be inserted in the circuit by throwing the appropriate toggle switches. Resistances would have sufficed, but would not have had the same psychological effect.

Provision for adding load to the circuits in various increments from 200 to 1,200 watts very effectively demonstrates the effect of increasing lamp size without altering existing wiring.

The fuseless breaker is included merely as a demonstration of modern equipment, while the voltmeter and lightmeter are necessary accessories.

An example of the kit's effectiveness is a recent office-building demonstration, wherein the owner was shown how low voltage by reason of inadequate wiring was causing lowered efficiency of his lamps. By showing him the actual voltmeter reading and by allowing him to note the increase in illumination when voltage was boosted up it became easy to explain to him how it was that he was actually paying for energy which was never converted into light.

22 Kw. Loss Shown

In the instance cited the non-productive energy amounted to 22 watts for each 150-watt lamp, of which there were more than 1,000, or a loss of more than 22 kw. for the building. When it was shown that this loss amounted to about $700 per year he promptly decided to launch a lighting and wiring modernization program. The foregoing considers only the loss through inefficient lamp operation, to say nothing of I^2R loss.

In addition to being used successfully with prospects, the kit has proved effective in classroom work, in which case it usually is augmented with a projection light meter.

On one occasion, when the demonstration was being presented to a local union of journeymen electricians in San Francisco, the wiremen were so impressed that they declared a recess while they went out and brought in the custodian of their building. Their conclusion was that a wiring modernization program—like charity—might well begin at home.

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Sheets, blocks, rods, tubes, rolls, ribbon rolls, fabricated parts. Taylor offers a complete service geared to the individual requirements of each manufacturer.

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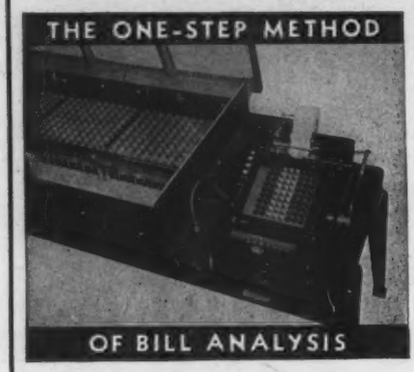

Cut these Costs in 1/2

- Customer Usage Data
- Rate Changes
- Load Fluctuation Data ... and many others

SAVES TIME!

● R & S ONE-STEP METHOD gives complete customer usage data currently at lower cost than periodic studies. Controlled accuracy eliminates re-checking and re-analyzing necessitated by other methods. Direct compilation from your billing register, or other customary record, eliminates advance preparation, field work, and interruption in your regular routine.

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Economic Study Determines Best Network Arrangement

[*Continued from page 54*]

justified by the saving in secondary copper as the secondary network expands and the load increases. With more installed transformer capacity the burning off of faults in the secondary network will be accomplished more readily and more decisively. More installed transformer units mean better voltage conditions for peak load and less voltage dip under starting current conditions. For these reasons it was decided to install the system on the basis of no overloading of transformers.

The remainder of the analysis can now be confined to those cost curves under the "No Overload" section. The extent of emergency conditions, for which a secondary network should provide service continuity, is a question of paramount importance in making an application. All network plans in this study were set up with the idea of utilizing two main substations. With provisions for a two-circuit outage it would be possible with four primary feeders installed to have continuous operation with one substation out of service. While such a scheme is highly desirable for most any system, its practicability is largely determined by its cost in relation to other schemes with less reliability. The additional cost represents a relatively small percentage of the ultimate cost of the secondary network to serve these loads and resulted in a decision to install the system on the basis of the two-circuit outage to guarantee continuity.

Use 500-Kva. Transformer

The size of transformer unit to be installed was selected as 500 kva., with due consideration to the importance of reduction in space requirements, and also the trend of increasing loads produced by air conditioning and higher intensity lighting. It is quite obvious that with the larger capacity transformer unit the economy in space in the total installation is appreciable on account of the fewer number of transformer units required and the increasing difficulty of getting suitable locations for street vaults. This decision was further justified with the realization that the cost and losses per kva. are reduced with the application of larger transformer sizes.

MEETS EVERY DEMAND . . . AT LOWER COST

The all-important tensile strength that steel alone provides . . . the ruggedness to withstand vigorous punishment . . . the ability to outlast normal needs . . . are combined to the highest degree in *Crapo* Galvanized Steel Strand.

Definite economies both in construction and maintenance are made possible by this time-tested product. Its comparatively low initial cost, its workability in the field and its consistently trouble-free performance in service are significant reasons for its selection by engineers for the more important construction jobs.

The extra-durability of *Crapo* Galvanized Steel Strand is directly traceable to its heavy, ductile, tightly-adherent zinc coating, applied by the *Crapo* Process of galvanizing, and to the care and precision of manufacture. Every size and grade of *Crapo* Steel Strand is produced from selected steel, uniformly processed and laboratory tested to insure close adherence to required standards.

***Crapo* Galvanized Steel Strand is readily available in all standard grades and sizes from representative jobbers throughout the country. Consult the distributor of *Crapo* Galvanized Products near you, or write direct for further information!**

INDIANA
STEEL & WIRE CO.
MUNCIE, INDIANA

As a consequence of these considerations the final plan called for two 34.5/13.8-kv., 5,000-kva. unit type network supply substations supplied directly from two existing transmission lines. This arrangement provides for two-circuit outages and failure of either substation or transmission line without interruption of service.

From each substation two 13.8-kv. primary cables supply each of the fifteen network transformers. Regulation is obtained by automatic tap changing under load. Voltage on the bus at each unit substation is held at 13.8 kv. to maintain a voltage of 123/213 volts at the customers' service. Resistance compensation is used at both substations. Operation has been satisfactory.

Fig. 4 shows the complete distribution system which is being installed. Eventually it will consist of a 4.33-kv. primary network serving residential areas, interconnected with the secondary network in the business area through a 13.8/4.33-kv. transformation at substation No. 3, so that the surplus capacity of the two 5,000-kva. network supply substations can be utilized to feed the 4.33-kv. primary network. This interconnection, however, cannot be made until the frequency conversion program is completed.

•

Weston Instrument Cuts Stock; Meets in Newark

The value of the capital stock of the Weston Electrical Instrument Corp., Newark, N. J., has been reduced from $2,500,000 to $2,050,000 by a conversion of all outstanding common stock to fully paid and non-assessable stock with a value of $12.50 a share. The change was affirmed at the recent annual meeting of stockholders. All directors and officers were re-elected.

Authorization was given the board of directors to make and alter the by-laws of the company, subject to the approval of the stockholders.

•

Plant Nears Completion

Goodrich Electric Co. of Chicago, manufacturer of porcelain enameled lighting fixtures for industrial use, reports that its new plant, located on the northwest side of Chicago, is nearing completion. The plant, which will have 146,000 sq.ft. of floor space, will be ready for occupancy in July or August.

MACHINING like this
Makes CONTACTS like this
Twirl the nut on *any* L-M Connector and note how smoothly it glides up the thread. Right there you have the evidence of *perfect machining*, and the big reason why L-M Connectors give you such high pressure between conductors at remarkably low torque. Machining like this, plus the high strength, corrosion-resisting, copper alloy that goes into them, enables L-M Connectors to withstand far higher ultimate torque than service conditions demand. *Save* . . . re-use your L-M Connectors over and over again. Their high conductivity assures low resistance connections, the day they come out of the carton . . . and twenty years later.
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L-M Nut Retainer Connector
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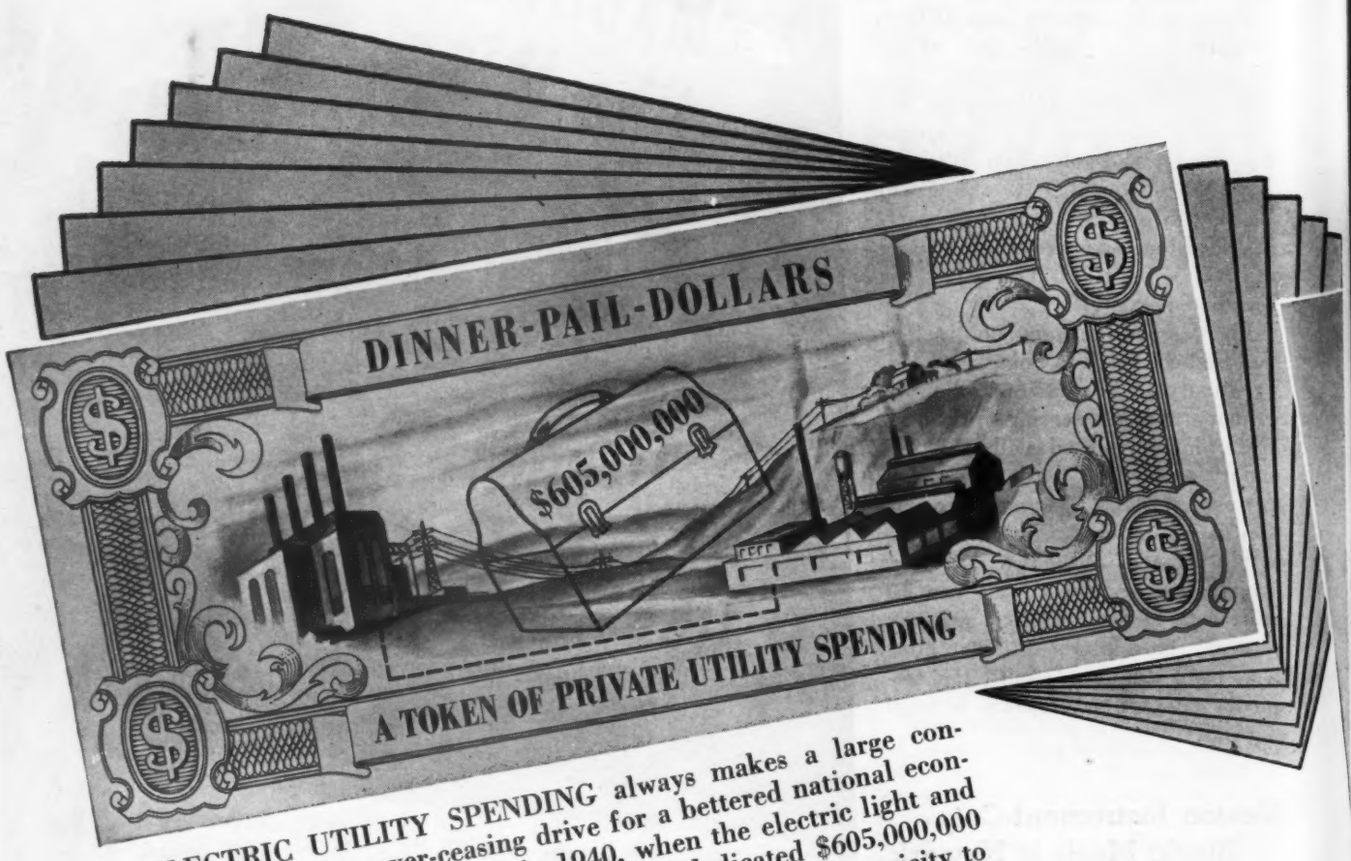
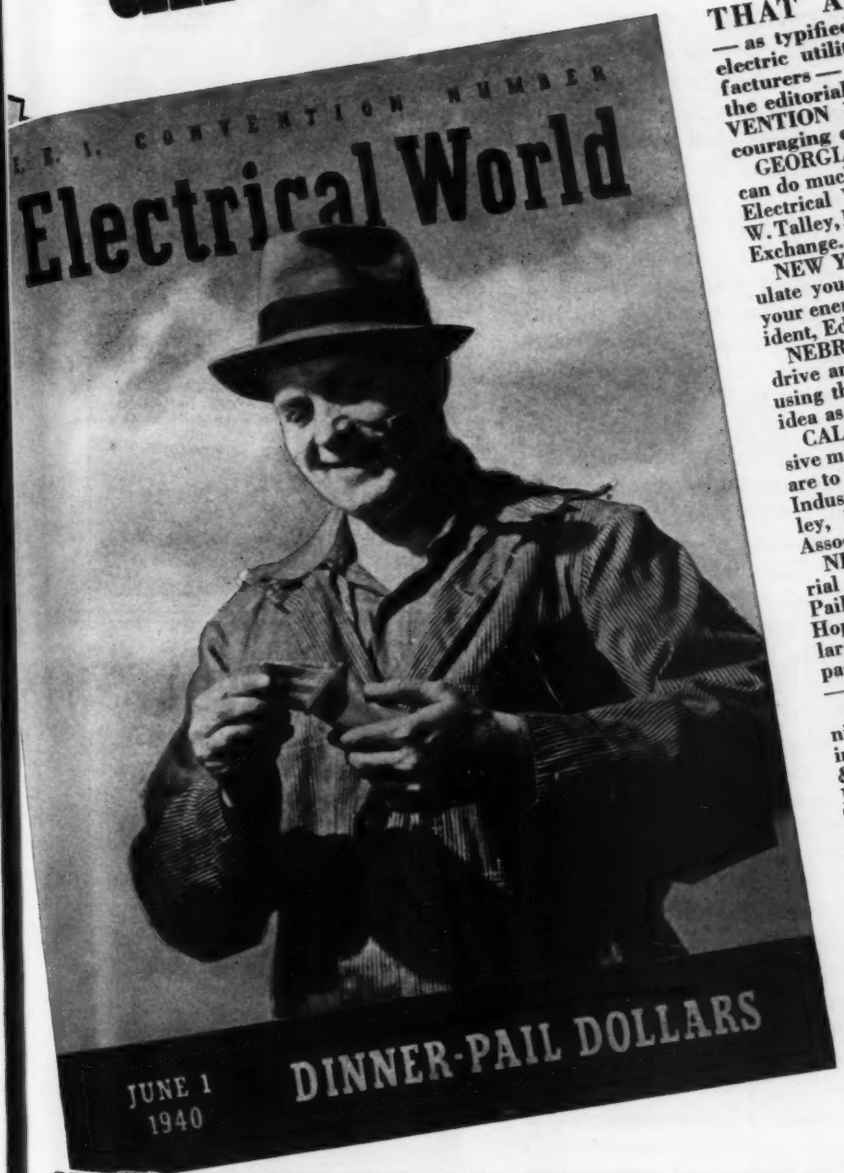
LINE MATERIAL CO.
MILWAUKEE, WISCONSIN



ELECTRIC UTILITY SPENDING always makes a large contribution to the never-ceasing drive for a bettered national economy. This is especially true in 1940, when the electric light and power industry in the United States has dedicated $605,000,000 to the peaceful endeavor of bringing the benefits of electricity to more people than ever before, through the medium of expansion and modernization—the largest construction budget in a decade and 41 per cent greater than last year's.

Aware of this contribution, and aware, too, that American industry needs more than ever to be reminded of it in this year of "wars and rumors of wars," ELECTRICAL WORLD editors coined the phrase "605-Million Dinner-Pail-Dollars" to describe the most significant editorial theme for the Edison Electric Institute Convention Number, out June 1, 1940.

Making a HIT all over the Country!



THAT AMERICAN INDUSTRY — as typified by chamber of commerce heads, electric utility executives and electrical manufacturers — wishes Electrical World success in the editorial objective of this year's E.E.I. CONVENTION ISSUE — is indicated by these encouraging comments from all over the country:

GEORGIA—"... the popularization of this idea can do much to help the utilities ... (We) commend Electrical World for instituting this program."—J. W. Talley, Executive Secretary, Southeastern Electric Exchange.

NEW YORK—"... this is a fine slogan. I congratulate you on your ingenuity in thinking of it and your energy in developing it."—C. W. Kellogg, President, Edison Electric Institute.

NEBRASKA—"... We are planning a membership drive and wonder what the possibility would be of using the slogan—"Dinner-Pail-Dollars" and also the idea as depicted."—Omaha Chamber of Commerce.

CALIFORNIA—"... this is a unique and impressive means of presenting a very timely story and you are to be congratulated. I'm passing this along to our Industry Information Committee."—Victor W. Hartley, Managing Director, Pacific Coast Electrical Association, Inc.

NEW YORK—"... congratulations on your editorial in the April 6 issue on the subject of Dinner Pail Dollars ... Your introduction of it is clever. Hope you'll send me one of these "Dinner-Pail-Dollars" and if you send a few extra ones, I'll be glad to pass them around as I get around over the country."—Ashton B. "Reddy Kilowatt" Collins.

OTHER PARTS OF U.S.A.—These power companies have asked for "Dinner-Pail-Dollars" to be put into circulation in their territories—Arkansas Power & Light Co., Central Illinois Light Co., Central Maine Power Co., The Dayton Power & Light Co., The Ohio Public Service Co., Pacific Power & Light Co., United Electric Light Co., The Washington Water Power Co., Illinois Iowa Power Co.

★ ★ ★

ALL OVER THE COUNTRY the effect of the 605-Million Dinner-Pail-Dollars will be felt. Read the June 1, 1940 issue of Electrical World for the dramatized story of what these "dollars" mean to the nation as a whole ... and to you as an individual. Fill out and mail the coupon today to reserve your copy.

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(If you are already a subscriber to Electrical World, you will automatically receive the "605-Million Dinner-Pail-Dollar" Issue, June 1, 1940 without extra cost. But if you want extra copies, we suggest you make your reservation now. Use the handy coupon!)

( ) ★ Please reserve.....copies at $1.00 each, postpaid, of the Annual E. E. I. Convention Number of Electrical World telling the dramatized story of "605-Million Dinner-Pail-Dollars." Please send my copies and bill to me at the address indicated in this coupon.

( ) ★ Please enter my subscription to Electrical World for one year, with the understanding that the Annual E. E. I. Convention Number of Electrical World, June 1, 1940 — the "605-Million Dinner-Pail-Dollar" Number — will be included without extra cost to me. Please bill me for 52 issues at $5.00 — (annual subscription price U.S.A.)

( ) ★ Please send me a "Dinner-Pail-Dollar"

My name ..... Title.....

Company .....

Address .....

City and State 5-4-40

Reliable

STRAIGHTLINE SPLICES

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High in strength -- Low in cost -- Positive in performance. Ends fit wire closely, dampening vibrations and preventing insertion of improperly prepared wires. A husky slotted washer maintains spacing of jaws preventing a strand from wedging between them. Jaws grip wire positively without cutting lines in it.

Reliable ELECTRIC COMPANY
OVER 25 YEARS SERVICE TO THE UTILITIES
3145 CARROLL AVENUE • CHICAGO ILLINOIS

Revenues Increase Under Commercial Cooking Plan

[*Continued from page 63*]

a revenue increase of 23 per cent, notwithstanding the rate reduction. This experience definitely proved the first two needs of commercial cooking sales—a promotional rate adapted to this business and a sales organization trained for it.

Competitive Equipment

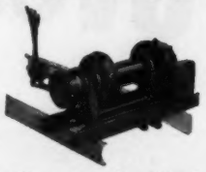
Probably the next essential to the building of a substantial commercial cooking load has been the development of commercial cooking equipment adapted to the restaurant man's needs at a more competitive price. During the first few years of our efforts we were constantly studying the restaurant man's needs and endeavoring best to adapt existing equipment to them. Results of Northwest Power company experiences were pooled with other power companies and responsive manufacturers brought out many equipment improvements and new designs priced to meet competition and the commercial cooking needs. In addition, during the last few years, new, specially designed electric cooking devices have been brought out that are far superior to any competitive fuel equipment. Among other developments the modern electric fry kettle and the steamless steam table are outstanding examples. These developments have been a major contribution to the continued progress of our commercial cooking load.

Successful Selling

The development of successful selling methods is another important factor in reaching this highly specialized commercial market. From the start, our program has been based on a non-merchandising co-operative selling policy. Merchandising activities of our company have been restricted to the sale of waterheaters, ranges and refrigerators in the domestic field, and it was not felt desirable to start a merchandising activity in commercial sales, which has been entirely conducted on a co-operative promotional basis. Many times it has seemed that this policy was a handicap. However, experience shows that it is a sound one. At first there was a definite lack of dealer sales personnel familiar with and interested in commercial electric equip-

GAR WOOD
WINCHES
DERRICKS • CRANES
FOR PUBLIC UTILITY TRUCKS

Gar Wood offers the most complete and dependable Hoisting, Hauling and Handling Equipment for increasing productive truck hours.



There is a Gar Wood WINCH to fit the job—a type for every Utility requirement.

CRANES for rapid handling of sewer, gas, water pipes, machinery and transformers.

HYDRAULIC REPAIR TOWERS for street light and power line maintenance.

DERRICKS for pole setting. Four sizes for 35' to 65' poles.

Bulletin W140A sent on request. Advise character of work to be done.

GAR WOOD INDUSTRIES, Inc.
WINCH DIVISION
DETROIT • MICHIGAN

GUARD AGAINST CURRENT DIVERSION with STAR METER SEAL

Saves many thousands of dollars annually by elimination of tampering and theft of current. Seals all types CS meters effectively and permanently. Cannot be removed without destroying or mutilating. SEND FOR SAMPLE.

The STAR PORCELAIN COMPANY
51 Muirhead Ave. Trenton, N. J.

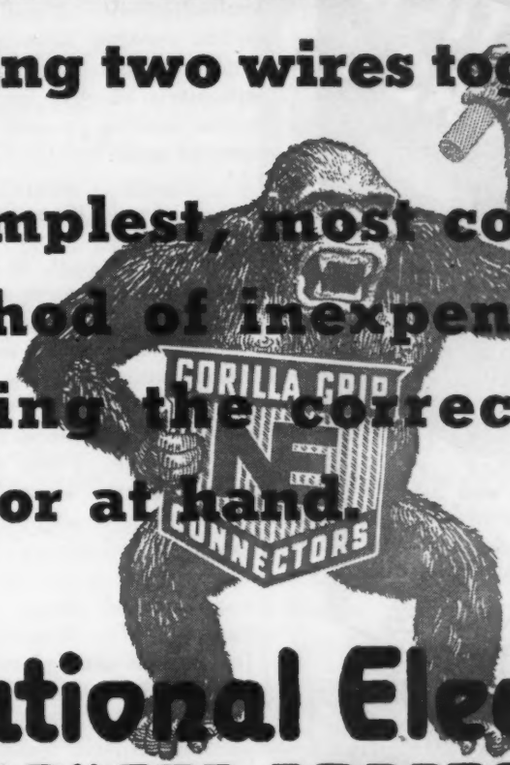
ment, and oftentimes there was a considerable lag between our promotional sales contacts and the dealers' closing contact, which results in many sales mortalities. However, as a result of our preliminary sales efforts, with the co-operation of active heavy duty manufacturers, this condition has been definitely improved. Where, previously, dealers were not interested in selling electric equipment, many of them are now very enthusiastic and have promoted special activities in this field Where many pieces of electric equipment were not readily available, dealer stocks are now adequate, and in many cases demonstration units are supplied to our representatives for special campaigns. Where, previously, dealer salesmen were not familiar with electric equipment, the "complete line salesman" now has much more complete information and dealers have several specialized electrical salesmen working in our territory,

Dealer Co-operation

We feel that the policy of co-operative non-merchandising promotion has multiplied our selling efforts several times and induces restaurant supply houses to sell with us rather than against us. Each year we have conducted at least one co-operative demonstration campaign which has definitely increased the sale of electric counter appliances. Under this plan the dealer supplies our representative with demonstration electric fry kettles or hot food demonstration units, which are demonstrated with temporary wiring to a selected group of prospects for periods of a week to ten days. The dealer salesmen follow up on the best prospects from these demonstrations and a high percentage of sales to demonstrations has been maintained. More than 50 per cent of the cooking load being added to our lines is in this counter cooking class and we have found that this provides a splendid foundation for the subsequent sale of complete electrification with electric ranges and bakeovens. These counter appliances provide splendid demonstrations of the advantages of commercial electric cookery to the restaurant man. With the initial steps of the block rate used up in counter appliances, the lower steps are more than competitive with other fuels in many cases. This demonstration plan has

Most flexible method of joining two wires together.

Simplest, most compact method of inexpensively having the correct connector at hand.



Booklet Free

National Electric
PRODUCTS CORPORATION
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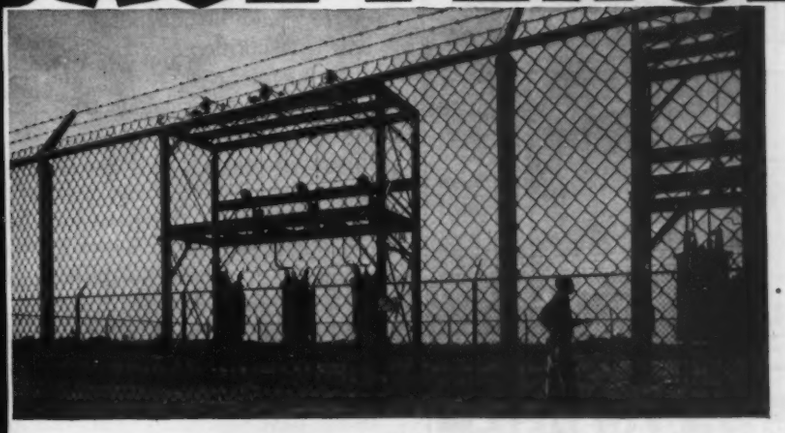

IN THIS CASE, 97=100%

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Page Fence is available in 5 superior metals: heavily-galvanized copper-bearing steel—Armco ingot iron—Alcoa aluminum—Allegheny stainless steel—iron picket. Only Page makes fence of all five metals. The stronger winged-channel post is exclusive. Write to PAGE FENCE ASSOCIATION, Bridgeport, Conn., Atlanta, Chicago, New York, Pittsburgh or San Francisco for book, "Fence Facts."

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America's First Wire Fence—Since 1883

EVERSTICK ANCHORS...
FIRST
In Dependability and Safety!
Made of Malleable Iron—proven on the toughest guying jobs—you can't go wrong by using Eversticks exclusively.
THE EVERSTICK ANCHOR CO.
FAIRFIELD, IOWA
Nut Housing locks EVERSTICK firmly on rod.
POWER TO HOLD

STAPUT FAIRLEADERS
Save Your Cables
Prevent Abrasion at the Duct Mouth
Low Cost Installation
Wm. B. Berry Co., 100 North St., Boston, Mass.

been supplemented in special activities with an electrically equipped demonstration truck and with special electric cooking shows. The truck demonstration method has been found particularly effective for introducing electric cooking to small towns and scattered areas.

Special Promotion

Last, but not least, we have found that adequate promotional advertising is essential to complete success in commercial cooking sales. During the early periods of our efforts advertising was limited to the use of manufacturing mailing pieces as they were made available. These were found hardly adequate alone because of their sporadic availability, and not completely satisfactory since they were confined to selling *equipment* and did not sell *electric cooking* as such.

In 1938 we initiated our first promotional advertising effort with a series of five mailing pieces of the illustrated customer testimonial type. Not only did we find this advertising effective in supporting and maintaining the sale of electric equipment during a depression period, but it apparently had an additional effect in stimulating continued use of existing electric appliances. As a result of this experience, we have been mailing monthly during 1939 a user magazine entitled *Electric Chef*, which contains pictures, stories and experiences of commercial electric cooking users in the Northwest. The cost of this publication, in addition to special promotional pieces, is comparable with the less effective previous efforts by virtue of production in large quantities for joint Northwest power company use.

Competitive rates, sales organization, training and selling methods, together with promotional advertising, have combined to provide very satisfactory load building in commercial cooking. During the 3¼ years that this program has been developing a total of 9,791 kw. of commercial cooking load has been added to our lines. From a very secondary source of added load, commercial cooking has come up to the point where last year the load added in this field exceeded that added in the commercial and industrial lighting field.

Customers using service under our commercial cooking and heating rate have increased 59 per cent during this period to the point where approximately 80 per cent of our commercial food servers have some form of electric cooking. During the last 3½ years annual kilowatt-hours have been increased 80 per cent, with the annual revenue increasing 45 per cent in spite of the substantial rate reduction. This has been done without merchandising loss, without wiring subsidy and with a very low personnel and advertising sales cost.

Market Potential

Looking at the future, we feel that there are even greater possibilities in this commercial cooking market. The most conservative market estimate would indicate that at most we have sold not more than 10 to 15 per cent of the market. This with approximately a 10 per cent replacement market occurring each year. There are certainly many ways in which our selling efforts can be improved. The problem of wiring costs has been and still is a major problem in many complete electrification jobs. It is our hope that simplified, less expensive, though adequate wiring designs can be worked out. With competitive operating costs, the many advantages of electric cookery should overshadow any reasonable heavy-duty wiring and equipment costs.

The theme of the National Restaurant Association is "Modernize, Mechanize, and Merchandise for Profit." Commercial electric cooking fits in with each of these slogans and is a major factor in developing commercial cooking profits. The commercial cooking field is a specialized field and can be sold most effectively with specialized salesmen. The commercial cooking salesman must be thoroughly familiar with the restaurant man's problems and know modern electric cooking methods. Where scattered territories require combination commercial men there is even a greater need for adequate and specialized training of these men. It is apparent from our operation that continued increases in the commercial cooking field will depend largely on continued promotional advertising, improved organization and training of sales representatives, and the further development of dealer co-operation and dealer electric sales training.

G.C.A.
Lamp Replacers
Lamp Base Removers
Cartridge Fuse Tongs
Switch Hooks

Send for Catalogue

We have been making safety tools for 24 years

THE G. C. A. Manufacturing Co.
Pittsfield, Mass.

HIGH GRADE HARD PORCELAIN
FOR
Electrical Specialties
High and Low Voltages

IMPERIAL PORCELAIN WORKS
TRENTON, NEW JERSEY

"IMPROVED METAL SNATCH"
Another
"ANVIL BRAND" BLOCK
In Favor With Linesmen

SEND FOR CATALOGUE

COMPLETE LINE TO
WESTERN BLOCK CO.
Market Street
Lockport, N. Y.
NEW YORK CITY
74 Murray St.
CHICAGO
34 N. Clinton St.

LETTERS TO THE EDITOR

Should Separate Site and Steam Costs

To the Editor of ELECTRICAL WORLD:

The central station industry is indebted to the ELECTRICAL WORLD for the assembly of data contained in Mr. Knowlton's "4th Steam Station Cost Survey," which appeared in the December 2, 1939, issue. The purpose of his article expressed in the first two paragraphs is commendable, for every station designer must answer those questions in arriving a the selection of unit sizes, pressure and temperature for his new station.

Our study of Mr. Knowlton's article, however, indicates that some of the conclusions arrived at are not borne out by the data nor by studies made on our own system to determine the type of new steam stations that should be built.

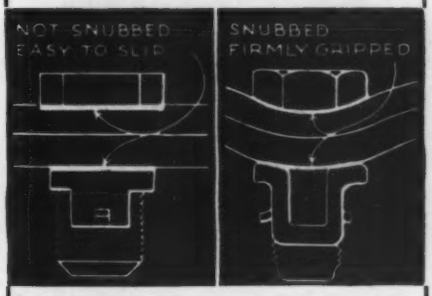
I need not call to your attention the contradictory nature of some of the conclusions nor to the assumption that the "most expensive plants are the ones loaded most steadily and most likely to carry peaks in excess of rating. This may be expressed by the desire . . . to realize on the heavier investments." The load dispatcher, who has the operation of a large number of plants under his control, is concerned mainly with the incremental cost of the different plants in his allocation of the load to these plants and not by the desire to realize on the heavier investments.

To cite one other instance, the following statements are made on page 51: "Skepticism about the over-all benefits from high boiler pressures appears also to be well founded in that the heat consumption per kilowatt-hour is hardly much better than for the more moderate pressures and temperatures. Actual loading seems to offset the theoretical gains." The author must not have borne the foregoing statement in mind when he added, on page 55, "Plants employing boiler pressures in the 1,200 to 1,450 pound class show in actual performance some 5 or 6 per cent better thermal economy than the average of those in the 600 to 900 pound class." While it is true that system demands may require that the flexible high-pressure plants operate away from their most efficient points, thus resulting in comparatively high station heat rates, the fact remains that the units have proved their worth in service, as indicated by the ever-increasing demand for high-pressure, high-temperature equipment.

In future surveys it is believed that the data would be more useful if

SHELDON SPLITBOLT
MAXIMUM FRICTIONAL EFFICIENCY SNUB GRIP
Connectors

Wires Won't Pull Out
when held by the
SHELDON SNUB-GRIP
...an *old* principle applied in a NEW way to connectors . . . it permanently holds two wires together the *tightest possible way!*



● A U-shaped Pressure Bar or Contact Pad allows the conductors to snub themselves in the "U". Ordinary "straight-grip" connectors have only a fractional pull-out value of Sheldon Splitbolts. And yet . . . the SNUB-GRIP is only one of ten reasons why Sheldon Splitbolts hold two wires together the tightest possible way! Send for full description and sample . . . today.

ORIGINATORS OF THE FRICTION-FREE PRINCIPLE FOR SPLITBOLTS

SHELDON
SERVICE CORPORATION
●
Long Island City, N. Y.

Sherman
SPLICING SLEEVES
Easier to Use . . More Durable and Dependable

Split Tinned

For splicing underground cables. Highest quality drawn copper, dead soft annealed. All standard and special shapes and sizes. Free from burrs.

Figure Eight

Extra quality electrolytic copper of correct temper. Seamless and free from burrs.

Oval Seamless

Precision made from finest electrolytic copper to N.E.L.A. standards. Carefully grooved to prevent buckling.

Sherman Splicing Sleeves enjoy an excellent reputation in the power industry, for their rugged service qualities. They are made in a variety of styles, to satisfy virtually all cable or wire splicing requirements, and comply with N.E.L.A. specifications.

Only the finest of materials are used in these sleeves, and they are made by precision methods that assure freedom from burrs and other defects. Write for Bulletin 20 describing the line, or let us send you free samples.

S

H.B. SHERMAN MFG. CO.

BATTLE CREEK, MICH.

grouped in such a way that costs peculiar to the site, such as land, circulating water, intakes and discharge flumes, etc., may be separated from those required for direct comparison of factors having to do with steam pressure and temperature and their comparative economy. Of course, fuel costs, fixed charges, maintenance, etc., under local conditions are factors that must be considered carefully by all power steam plant designers. These items must be balanced one against the other to provide a proper solution as to the economic justification of a new plant or the extension of an old station.

N. R. GIBSON, Vice-President
Buffalo Niagara & Eastern Power Corp., Buffalo, N. Y.

•

Grade E, Not Grade A Activated Alumina

To the Editor of ELECTRICAL WORLD:

After publication of my article "Heaters Prevent Condensation on Hydro Station Generators," which appeared in the April 6 issue of ELECTRICAL WORLD, I find that an error was made in the original manuscript concerning the statement, "a breather filled with twenty pounds of Grade A, 4-8 mesh activated alumina." The correct statement is, "a breather filled with twenty pounds of Grade E, 8-14 mesh activated alumina."

The distinguishing characteristic of Grade E, besides being used in a smaller grain size, is the use of a color chemical in the Grade E which changes from blue to pink after having adsorbed its maximum capacity of moisture. Grade A, which is plain white in color, will give the same action, but you cannot tell by looking at it when it should be reactivated.

J. E. HOUSLEY, Supt. of Power
Aluminum Company of America, Alcoa, Tenn.

•

Other Limitations to Diesel Revolution

To the Editor of ELECTRICAL WORLD:

Your editorial in the March 9, 1940, issue called "The Diesel Revolution Gets a Convert" did not mention three other very important points which will limit the speed with which the Diesel revolution may take place. These points are the dirt, odor and noise which accompany any individual power plant installation of this type. Can you imagine a good residential neighborhood with a Diesel plant humming away in every house?

H. A. BREEDING,
Illuminating Laboratory,
General Electric Company,
Schenectady, N. Y.

Penetrating the BIG Electrical MARKET . . .

ANOTHER IMPORTANT REASON WHY

Good Advertising Pays in

Electrical World

Sales Opportunities

CHICAGO, ILL. — Commonwealth Edison Co. has filed plans for remodeling and improving power substation at 6753 North Wolcott Avenue, and will proceed with work at once. Additional equipment will be installed.

GRAND FORKS, N. D.—Minne-Kota Electric Power Cooperative, Inc., Grand Forks, recently organized by P. J. Conelly, Grafton, N. D., president, and associates, has engaged Ellerbe & Co., First National Bank Building, St. Paul, Minn., consulting engineers, to make surveys and plans for new rural electric system in several counties in North Dakota and Minnesota, comprising an area in the Red River Valley. Project will include primary and secondary lines, outdoor power substations, service connections and other operating facilities. Estimates of cost will be made soon. Victor Edman, Alvarado, Minn., is secretary and treasurer.

FORT WORTH, TEX.—American Asphalt Roof Corp., Fifteenth Street and Blue River Avenue, Kansas City, Mo., plans installation of motors and controls, regulators, duct lines, conveyors, switchgear and other equipment in new branch plant on 11-acre tract of land on West Fifth Street, Fort Worth, for manufacture of roofing products. It will consist of two main units and auxiliary buildings, with other structures to be erected at a later date. Work is scheduled to begin at once. Cost estimated over $250,000. Wyatt C. Hedrick, First National Bank Building, Fort Worth, is architect.

JACKSONVILLE, FLA.—Bureau of Yards and Docks, Navy Department, Washington, D. C., receives bids (no closing date stated) for power plant equipment for naval air station at Jacksonville, including boilers, oil burners, combustion control apparatus, draft fans, water-treatment and continuous blow-down equipment, pumping units, fuel oil pumping and heating equipment, gasoline engine-driven electric alternator, air compressors, air filters, cooling tower, switchgear, instruments and auxiliary equipment (Specifications 9415).

MUSKOGEE, OKLA.—Grand River Dam Authority, Vinita, Okla., plans new 66,000-volt transmission line from point near Fort Gibson, where connection will be made with high-tension system, to Muskogee, Okmulgee and vicinity, for power supply at latter points, where distribution substation will be located. Cost estimated over $150,000. Holway & Neuffer, 302 East Eighteenth Street, Tulsa, Okla., are consulting engineers.

CRYSTAL FALLS, MICH.—Wisconsin-Michigan Power Co., Appleton, Wis., is having plans prepared by Holland, Ackerman & Holland, Ann Arbor, Mich., consulting engineers, for new storage dam on upper falls of Michigamme River, about 7 miles from Crystal Falls, for increased water supply for hydro-electric generating plant near latter place, previously referred to in these columns. Permission for project has been secured and it is proposed to begin work in June. Cost estimated close to $300,000.

BALTIMORE, MD.—Frankfort Distilleries, Inc., Columbia Building, Louisville, Ky., plans installation of motors and controls, regulators, switchgear, conveyors, loaders and other equipment in connection with expansion and improvements in plants at Baltimore and Dundalk, Md. Cost reported over $800,000. Work will be carried out at once.

BROOKLYN, N. Y.—Signal Corps Procurement District, Army Base, Fifty-eighth Street and First Avenue, Brooklyn, receives bids until May 14 for 14,400,000 to 24,000,000 lineal feet of wire, and for 47,520,000 to 160,802,400 lineal feet of wire (Circular 394); also, at same time, for 4000 to 9000 reels, and for 7000 to 30,000 reels (Circular 395); until May 17, for 450 mast bases, 1800 mast sections, etc. (Circular 408); and, until May 21, for 8800 lineal feet of cable and reels (Circular 418).

MARSHFIELD, WIS.—Electric and Water Department will take bids about May 15 for proposed municipal power station, 40 x 100 feet, recently referred to in these columns, to include turbine unit, switchboard and accessory equipment; a 25-ton traveling crane will be installed. Project estimated to cost close to $100,000. Helmick, Eduskuty & Lutz, Essex Building, Minneapolis, Minn., are consulting engineers.

LEWISTOWN, PA.—Pennsylvania Edison Company, Altoona, Pa., plans extensions and improvements in Riverside power substation, Lewistown, with installation of additional equipment for increased capacity. Also will carry out similar work at substation at Cresson. Transmission lines in this same area will be modernized and extended. Work is scheduled to be placed under way this spring. This is part of 1940 expansion program of company.

WAYNE, NEB.—Wayne County Rural Public Power District, Wayne, has plans maturing for primary and secondary lines for extensions in rural electric system in parts of Wayne, Dixon, Pierce and neighboring counties, totaling close to 200 miles in all, with service facilities. Cost estimated about $225,000. Application has been made for permission and work will begin as soon as authority is granted. H. H. Henningson, 1904 Farnam Street, Omaha, Neb., is consulting engineer.

EAST MOLINE, ILL.—International Harvester Co., 180 North Michigan Avenue, Chicago, Ill., plans installation of motors and controls, switchgear, transformers and accessories, power panels, duct lines, conveyors, electric hoists and other equipment in new one-story addition, 393 x 770 feet, to farm tractor and machinery plant at East Moline, for which superstructure is scheduled to begin at once. Award for building erection has been let to Tunnicliff Construction Company, 105 Fillmore Street, Davenport, Iowa. Cost estimated close to $1,000,000. James D. McGann, first noted address, is company superintendent of buildings.

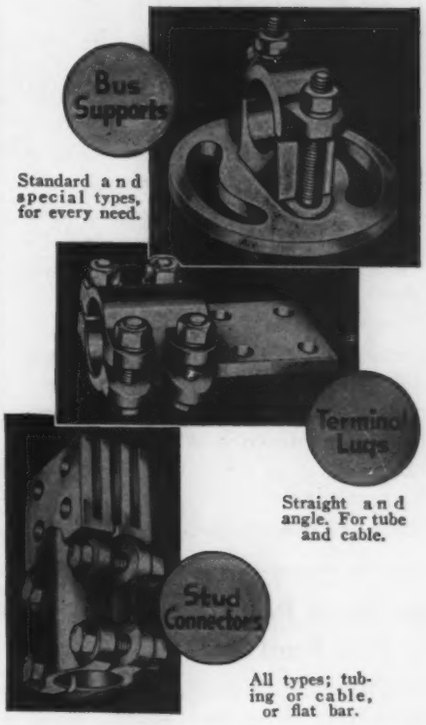
TONGUE POINT, ORE.—Public Works Officer, Commander R. E. Thomas, Puget Sound Navy Yard, Bremerton, Wash., receives bids until May 15 for steam power plant equipment, reinforced-concrete stack, electrical and steam distribution systems at naval air station, Tongue Point (Specifications 9484).

WILSON, N. C.—City Council receives bids until May 8 for equipment for municipal power plant, where expansion and improvements will be made, including 7500-kw. turbine-generator unit and accessories, surface condenser, switchgear, motor-driven boiler-feed pump with capacity of 250 gallons per minute, and auxiliary apparatus. William C. Olsen, Raleigh, N. C., is consulting engineer.

Preferred *because they are* **Dependable**

The leading utility companies and "industrials" use PENN-UNION fittings to make certain of *dependable* connections.

They know that *every* Penn-Union fitting is carefully designed and manufactured . . . thoroughly tested.



Standard and special types, for every need.

Straight and angle. For tube and cable.

All types; tubing or cable, or flat bar.

These fittings are high conductivity copper alloy, with machined contact surfaces.

More than 6,200 items in the Penn-Union line . . . for every type of electrical connection . . . . . including many NEW and IMPROVED fittings.

Sold by Leading Jobbers

Write for catalog.

PENN-UNION ELECTRIC CORPORATION
ERIE, PA.

You'll find it in the *complete* line

PENN-UNION
Conductor Fittings

Drive Modernization Raises Paper Production 32%

[*Continued from page 61*]

and capacity of the carbon pile differential speed regulator.

With all engineering details completed, plans for the actual changeover were carefully formulated to insure a minimum delay in production. Operation in this plant is on a continuous seven-day basis and each 24-hour interruption is evaluated at several thousand dollars. As much of the work as possible was done before the shutdown and was so scheduled as to avoid interference with production. After a careful check, to make sure that all required apparatus was available, the mill was shut down at 7 a.m. on July 20. In line with the schedule, a different group of men under the supervision of a specially trained engineer was assigned to each specific job.

At 6 p.m. on July 23—exactly 83½ hours after the mill was shut down—it was back in full production after only minor difficulties. Four days later a continuous 30-hour run of nine-point paper was made at 1,060 ft. per minute without further difficulty or adjustment.

Robbing Peter to Pay Paul

[*Continued from page 66*]

the family lived in a $4,000 house the difference in city and school taxes in favor of Buffalo would be $22.60 annually. "The tax Peter robs to pay the power Paul in Canada as well as in TVA."

Per capita government expenditures in 1901 in Quebec were $2.74, Mr. Bender says, and $1.85 in Ontario. Then government ownership of electric distribution came to Ontario. In 1911 Ontario had a government cost of $3.92 per capita, Quebec $3.20. In 1937 government costs in Ontario were $26.35 per capita, in Quebec $14.02.

It's sort of nice to have cheap electricity, if you don't pay too much for it!

•

Power Contract Signed

Contract has been signed with the Arizona General Utilities Co. for supplying power to the Graham unit of the Cochise-Graham rural electrification project.

SEARCHLIGHT SECTION

(Classified Advertising)

EMPLOYMENT : "OPPORTUNITIES" : EQUIPMENT
BUSINESS : : USED OR RESALE

UNDISPLAYED —RATES— DISPLAYED

10 CENTS A WORD. MINIMUM CHARGE $2.00
Positions Wanted (full or part time salaried employment only), ½ the above rates payable in advance.
Box Numbers—Care of publication New York, Chicago or San Francisco offices count as 10 words.
Discount of 10% if full payment is made in advance for 4 consecutive insertions.

Individual Spaces with border rules for prominent display of advertisements.

The advertising rate is $6.50 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

An advertising inch is measured ⅞" vertically on one column, 3 columns—30 inches—to a page.

Copy for new advertisements must be received by 10 A. M. Monday for the issue out Saturday.

POSITIONS VACANT

(See also "Selling Opportunity Offered")

ENGINEER experienced in staking R E A distribution lines. Box 24, East Montpelier, Vermont.

EMPLOYMENT SERVICE

SALARIED POSITIONS, $2,500 to $25,000. This thoroughly organized advertising service of 30 years' recognized standing and reputation carries on preliminary negotiations for positions of the caliber indicated above, through a procedure individualized to each client's personal requirements. Several weeks are required to negotiate and each individual must finance the moderate cost of his own campaign. Retaining fee protected by a refund provision as stipulated in our agreement. Identity is covered and, if employed, present position protected. If your salary has been $2,500 or more, send only name and address for details. R. W. Bixby, Inc., 262 Delward Bldg., Buffalo, N. Y.

EXECUTIVES AND TECHNICAL MEN. Contact employers for positions through our confidential and effective methods. We negotiate preliminary overtures. Established 24 years. Inquiries invited. H. H. Harrison, Director. The National Business Bourse, 20 West Jackson Blvd., Chicago.

EXECUTIVES $2,400-$25,000. This reliable service, established 1927, conducts confidential negotiations for high grade men who either seek a change, or the opportunity of considering one, under conditions assuring, if employed, full protection to present position. Send name and address only for details. Jira Thayer Jennings, Dept. G—9 Center Street, New Haven, Conn.

POSITIONS WANTED

(See also "Selling Opportunity Wanted")

POWER SALES ENGINEER with distribution engineering background desires new connection. Six years experience diesel and steam competition, industrial power applications. Details training, experience, references on request. Now employed. PW-751, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

ELECTRICAL ENGINEER—18 years experience as engineer, estimator and designer on power houses, substations and chemical plants. Permanent connection desired with a public utility or large industrial firm. PW-755, Electrical World, 330 W. 42nd St., New York, N. Y.

VALUATION OR PLANT RECORDS—Original cost-accounting and engineering training, 20 years experience — knowledge of I.C.C. and F.P.C. requirements. PW-757, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

Seeking connection with Small Utility, private or Municipal plant. 20 years experience in construction, maintenance and operation Hydro preferred. 40 years old. PW-758, Electrical World, 330 W. 42nd St., New York, N. Y.

SELLING OPPORTUNITIES
OFFERED—WANTED
Selling Agencies—Sales Executives
Salesmen—Additional Lines

OPPORTUNITY OFFERED

ESTABLISHED SALES REPRESENTATIVE wanted to handle, on commission basis, nonferrous condenser tubes to the Public Utility and Marine fields along the Eastern seaboard. In reply state experience and other products now handled. RW-756, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

OPPORTUNITY WANTED

Immediate results obtainable, have covered Minnesota, Wisconsin and Northern Peninsula Michigan last fifteen years for electrical manufacturer, desire agency connection. P. O. Box 1778, Milwaukee, Wisconsin.

WANTED for Canada

If your present Canadian Manufacturing connection or distribution is not satisfactory or you want to enter this field, we think it can be proven to you that we can materially increase your volume and profits.

We are a financially responsible Canadian Manufacturer of Electrical equipment selling to utilities and large industries with very complete Dominion sales coverage.

Write in confidence

RA-740, Electrical World
330 West 42d St., New York City

WANTED

WANTED
SYNCHRONOUS MOTOR
800 HP Synchronous Motor, 3 phase, 60 cycle, 2300 volts, 600 RPM or Alternator. Also—1200 HP 3/60/2300, 900 RPM syn. or alternator.

W-753, Electrical World,
520 No. Michigan Ave., Chicago, Ill.

At Your Service

—the Searchlight Section of the McGraw-Hill publications is at your service for bringing business needs or "opportunities" to the attention of men associated in executive, management, sales and responsible technical, engineering and operating capacities with the industries served by McGraw-Hill publications.

Supplement to ELECTRICAL WORLD, May 4, 1940
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Table I—Data on Output and Peak Load of Largest Generating and Di

Systems in North America, 1936-1939

Public utility, lighting, power and electric railway systems in the United States, Canada and Mexico having output in excess of 100,000,000 kw.-hr. during 1939

Line No.	Company and System	1939				1938				1937				19	
		System Peak Load (60-Minute) Incl. Purch. Energy Kw. (See Note a)	Peak Load on Generator Stations (60-Minute) Kw. (See Note a)	Generator Rating Kw.	Output for Year (Incl. Purch. Energy) Thousand Kw.-Hr.	System Peak Load (30-Minute) Incl. Purch. Energy Kw. (See Note a)	Peak Load on Generator Stations (30-Minute) Kw. (See Note a)	Generator Rating Kw.	Output for Year (Incl. Purch. Energy) Thousand Kw.-Hr.	System Peak Load (30-Minute) Incl. Purch. Energy Kw. (See Note a)	Peak Load on Generator Stations (30-Minute) Kw. (See Note a)	Generator Rating Kw.	Output for Year (Incl. Purch. Energy) Thousand Kw.-Hr.	System Peak Load (30-Minute) Incl. Purch. Energy Kw. (See Note a)	Peak Load on Generator Stations (30-Minute) Kw. (See Note a)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
	United States														
1	Niagara Hudson System (C)	1,316,000	1,196,500	1,576,638	7,618,593	(o) 1,225,400	(o) 1,039,400	1,606,298	7,304,560	(o) 1,274,300	(o) 1,091,400	1,611,342	8,056,607	(o) 1,232,700	(o) 1,122,900
2	Commonwealth Edison Co. and Subs. (D)	1,535,000	1,514,000	2,005,765	7,561,618	1,405,000	1,390,400	2,005,765	6,711,103	1,375,000	1,361,100	1,856,200	7,124,493	1,348,600	1,342,400
3	Consolidated Edison Co. of New York, Inc. (D)	1,660,000	1,669,000	2,566,300	7,376,854	1,645,000	1,585,500	2,566,300	6,714,417	1,507,500	1,459,000	2,346,200	6,538,147	1,449,000	1,446,000
4	Pacific Gas and Electric Co	(k) 1,059,800		1,300,969	5,728,404	980,000		1,250,969	5,177,338	990,200		1,250,969	5,182,043	929,700	
5	American Gas & Elec. Co. (Central System)	909,320	921,620	1,128,826	4,759,531	803,135	800,180	993,267	4,072,081	(o) 822,460	(o) 794,600	1,013,257	4,780,963	(o) 800,120	(o) 769,945
6	Philadelphia Electric Co., System	(b) 907,000	(b) 936,000	1,126,125	4,253,421	837,000	862,000	1,127,125	3,849,519	789,000	834,000	1,097,375	3,833,949	(m) 831,000	(m) 837,000
7	Southern California Edison Co., Ltd	(m) 684,500		1,096,170	3,618,199	(m) 579,000		931,550	3,058,175	(m) 580,500		931,550	3,138,654	(m) 645,400	
8	The Detroit Edison Co	(k) 769,900	(k) 763,400	1,020,675	3,127,969	666,900	663,900	960,825	2,689,403	660,100	653,000	930,825	3,217,075	671,000	656,200
9	Public Service Electric & Gas Co	700,800	644,900	737,700	2,994,947	623,400	588,000	737,700	2,678,396	575,650	519,000	684,450	2,747,123	582,225	502,750
10	Duke Power Co	(m) 599,275			2,759,247	(m) 530,230			2,307,908	(m) 494,745			2,385,189	(m) 487,000	
11	Tennessee Valley Authority *	674,100	674,100	838,364	2,756,966	266,000	266,000	487,338	1,288,834	(o) 160,400	(o) 160,400	413,300	494,799	213,500	213,500
12	Agencies Distributing TVA Power (Consol. Rep't)				944,123										
13	Alabama Power Co	589,490	476,490	579,879	2,596,828	(o) 465,700	(o) 441,700	579,879	2,132,738	(o) 505,900	(o) 496,900	579,744	2,347,861	491,900	410,500
14	Bureau of Reclamation (Boulder Dam)		(b) 589,200	704,800	2,507,932			539,800	1,522,627	319,200	319,200	370,000	1,166,681	162,000	162,000
15	New England Power Association (Consolidated)	587,900	489,600	711,014	2,490,936	(o) 532,300	(o) 440,000	711,014	2,174,696	(o) 526,500		719,310	2,373,707	(o) 529,400	
16	American Water Works & Electric Co., Inc	473,097	465,697	627,800	2,470,563	(o) 409,558	(o) 401,218	618,579	2,136,864	(o) 432,759	(o) 411,600	590,679	2,543,471	(o) 416,392	(o) 399,342
17	Union Electric Co., of Missouri and Subs	(m) 476,000	(m) 476,000	692,420	2,468,422	(m) 448,000	(m) 448,000	692,420	2,254,291	(m) 443,000	(m) 443,000	651,670	2,399,584	426,260	
18	Georgia Power Co	427,300		381,939	2,050,359	(o) 374,400		382,114	1,758,406	(o) 361,100	(o) 291,100	384,624	1,870,625	(o) 342,900	(o) 330,780
19	Duquesne Light Co	422,500	424,100	504,000	2,007,780	(o) 349,300	(o) 350,100	504,000	1,654,105	(o) 360,100	(o) 348,300	444,000	1,836,112		(o) 367,000
20	Pennsylvania Power & Light Co	379,956	314,400	391,689	1,874,595	(o) 360,300	(o) 302,902	391,689	1,752,164	345,000	266,800	392,189	1,778,250	(o) 348,800	(o) 262,200
21	The Cleveland Electric Illuminating Co	416,900	416,900	523,750	1,820,146	(j) 387,214	(j) 387,214	527,500	1,548,630	(j) 360,223	(j) 362,223	477,500	1,707,031	353,868	354,868
22	Consumers Power Co	420,986		473,715	1,733,120	(o) 371,070		417,915	1,509,917	(o) 372,900	(o) 333,460	413,215	1,691,884	(o) 329,901	(o) 300,677
23	City of Los Angeles Dept. of Water & Power	(k) 400,400	(k) 381,400	562,105	1,691,044	377,600	377,600	562,105	1,555,238	366,500	366,500	562,105	1,506,171	(m) 230,300	(m) 221,300
24	Cons. Gas Electric Light & Power Co., Baltimore	(e) 307,000	215,000	250,950	(g) 1,646,037	(e) 276,000	(o) 142,000	230,950	(g) 1,430,008	(e) 300,000	(o) 144,000	230,950	(g) 1,508,886	(e) 285,200	(o) 167,000
25	Columbia Gas & Electric Corp. and Subs. (D)	383,300		511,750	1,572,309	345,600		476,750	1,399,199	324,200		406,750	1,510,463	308,000	
26	Wisconsin Electric Power Co., and Affil. Cos. (D)	(m) 356,553		(p) 547,480	1,550,252	317,740		(p) 530,740	1,424,858	343,061		531,714	1,506,345	300,976	
27	The Montana Power Co	275,400	275,400	342,000	1,491,796	(o) 236,500	(o) 236,500	350,000	1,295,283	(o) 258,500	(o) 255,500	294,000	1,559,436	243,300	243,300
28	Northern States Power Co. (Minn.) and Sub	(m) 329,575	(m) 326,575	456,661	1,461,401	(m, s) 299,459	(m, s) 294,609	460,611	1,341,865	278,374		420,151	1,319,245		(s) 252,534
29	Boston Edison Co	372,590	323,265	389,160	1,453,365	(m) 336,995	(m) 293,210	359,160	1,203,804	(m) 305,430	(m) 249,040	359,160	1,274,633	(m) 320,966	(m) 278,000
30	Penn. W. & P. Co.,—Safe Harbor W. P. Corp	332,000	332,000	311,000	1,319,195	(o) 335,000	(o) 335,000	311,000	1,548,165	(o) 335,500	(o) 335,500	311,000	1,848,643	(o) 334,000	(o) 334,000
31	Ohio Edison Co	243,400	229,100	333,450	1,189,132	(o) 227,300	(o) 224,600	333,450	1,078,285	(o) 243,100	(o) 236,000	313,450	1,280,943	(o) 227,700	(o) 220,800
32	Puget Sound Pwr. & Lt. Co	(m) 249,310	(m) 228,160	315,185	1,155,039	(m) 233,170	(m) 228,170	315,245	1,047,416	(m) 232,410	(m) 230,635	319,745	1,233,901	(m) 219,240	(m) 214,440
33	The Washington Water Power Co. (p)	189,600	182,400	203,534	1,033,419	(o) 182,100	(o) 182,100	203,534	980,407	(o) 228,200	(o) 193,800	203,534	(o) 1,278,809	(o) 189,700	(o) 178,840
34	Potomac Electric Power Co	218,000	201,000	255,000	993,139	(o) 198,000	(o) 178,000	255,000	910,962	(o) 189,000	(o) 154,000	220,000	835,168	(z) 179,000	(u) 152,000
35	Utah Power & Light Co	170,010	145,910	240,177	940,498	(o) 150,440	(o) 125,730	240,177	762,765	147,200	133,630	241,142	919,184	143,260	126,880
36	New York State Electric & Gas Corp. (D)	(l)	(l)		939,302	179,840	87,565	122,710	876,706	(o) 171,837	(o) 84,100	103,445	819,824	(o) 157,400	(o) 105,010
37	Carolina Power & Light Co	255,820	196,400	249,050	923,281	(o) 245,540	(o) 194,860	249,050	890,938	(o) 273,280	(o) 198,320	249,050	1,035,987	(o) 236,160	(o) 196,040
38	Public Service Co., of Indiana	(k) 179,280	(k) 139,500	133,520	859,706	164,730	134,700	133,520	736,972	158,650	117,500	136,520	774,931	152,560	114,500
39	Northern Indiana Public Service Co	(k) 159,196	(k) 82,436	115,455	799,316	141,494	82,405	111,455	707,746	137,610	82,300	91,455	811,820	123,210	82,470
40	Kansas City Power & Light Co	(c, m) 148,800	(c, m) 148,800	283,925	782,861	(c, m) 143,400	(c, m) 143,400	277,925	749,787	151,700	151,700	263,211	757,407	135,100	135,100
41	The Connecticut Light & Power Co	174,231	147,549	194,625	780,108	(o) 154,070	(o) 127,435	194,865	670,029	154,872	129,935	196,815	748,186	(o) 149,504	(o) 124,443
42	Virginia Electric & Power Co	170,500	172,400	171,535	774,282	(o) 142,700	(o) 141,800	171,535	679,448	(o) 133,200	(o) 133,900	173,035	664,860	(o) 127,600	(o) 127,300
43	Idaho Power Co	110,225	103,110	102,410	766,549	(o) 106,821	(o) 101,935	102,135	657,375	92,302	(o) 86,085	100,985	609,466	(o) 81,797	(o) 78,667
44	Louisiana Power & Light Co	115,000	96,000	86,868	745,302	109,075	96,000	86,868	654,876		96,000	86,874	760,703	113,262	96,000
45	Portland General Electric Co	171,000	144,000	183,465	744,545	(o) 152,000	(o) 140,000	183,465	676,706	(o) 144,000	(o) 140,000	183,000	704,759	(o) 145,000	(o) 141,000
46	Houston Lighting & Power Co	147,600	146,700	206,586	740,275	(o) 130,400	(o) 129,100	181,586	684,906	(o) 121,200	(o) 117,300	181,586	659,912	(o) 110,000	(o) 110,400
47	Metropolitan Edison Co.*	158,700	149,800	190,928	733,497	214,300	169,000	246,198	797,956	(o) 186,300	(o) 174,400	246,198	952,593	(o) 176,300	(o) 163,300
48	Gulf States Utilities Co	118,028	117,610	181,516	724,664	97,959	97,506	148,016	598,534	(o) 70,441	(o) 70,019	75,596	367,401	(o) 58,330	(o) 56,955
49	The Ohio Public Service Co	143,400	106,600	129,100	655,688	116,800	90,400	129,600	530,560	129,100	97,900	125,100	624,774	111,800	100,200
50	Oklahoma Gas & Electric Co	(b) 125,276	(b) 121,320	(y) 170,176	652,459	122,336	120,452	173,476	642,904	125,096	124,104	173,676	691,821		97,689
51	Texas Power & Light Co	133,450	107,750	96,940	638,047	(o) 127,400	(o) 104,620	98,431	604,559	(o) 125,610	(o) 104,480	98,616	588,397	(o) 112,850	(o) 101,680
52	The California Oregon Power Co	114,955	111,855	115,080	600,284	105,135	105,135	115,080	565,815	110,980	106,175	115,430	575,585		106,252
53	The Hartford Electric Light Co	114,700	121,000	165,500	571,449	102,000	106,200	165,500	372,734	100,700	103,300	125,500	242,016	102,300	90,800
54	Central Maine Power Co	109,300	108,400	133,097	565,112	103,752	103,452	125,922	521,477	101,900	100,200	125,922	536,254	104,660	
55	The Toledo Edison Co	147,940	140,940	180,280	553,179	130,940	113,840	180,280	474,081	116,020	108,020	177,380	551,993	109,000	98,000
56	Northwestern Electric Co	109,200	50,000	52,100	548,761	(o) 105,400	(o) 56,700	52,100	421,490	(o) 82,600	(o) 51,200	52,100	439,684	75,786	
57	Hetch Hetchy Water Supply, (San Francisco)	84,700	84,700	83,000	525,993	87,800	87,800	83,000	531,402	(o) 87,700	(o) 87,700	83,300	506,712	83,500	83,500
58	Indianapolis Power & Light Co	(k) 123,300	(k) 123,300	184,000	522,327	104,900	104,700	175,700	456,598	110,000	110,000	165,200	472,852	94,750	83,750
59	Public Service Co., of Colorado	108,638	107,440	157,482	499,674	(o) 101,480	(o) 99,920	155,162	481,374	(o) 95,310	(o) 94,000	126,562	472,369	(o) 89,690	(o) 88,260
60	Arkansas Power & Light Co	96,000	77,000	107,998	496,709	(o) 93,200	(o) 68,000	108,004	459,924	88,541	69,400	108,514	452,466	(o) 81,700	(o) 68,000
61	Central Illinois Public Service Co	128,200	71,700	75,000	491,175	112,800	69,900	75,000	461,301						

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—Data on Output and Peak Load of Largest Generating and Distributing Systems in North America, 1936-1939

Public utility, lighting, power and electric railway systems in the United States, Canada and Mexico having output in excess of 100,000,000 kw.-hr. during 1939

ny and System (2)	1939 System Peak Load (60-Minute) Incl. Purch. Energy Kw. (See Note a) (3)	1939 Peak Load on Generator Stations (60-Minute) Kw. (See Note a) (4)	1939 Generator Rating Kw. (5)	1939 Output for Year (Incl. Purch. Energy) Thousand Kw.-Hr. (6)	1938 System Peak Load (30-Minute) Incl. Purch. Energy Kw. (See Note a) (7)	1938 Peak Load on Generator Stations (30-Minute) Kw. (See Note a) (8)	1938 Generator Rating Kw. (9)	1938 Output for Year (Incl. Purch. Energy) Thousand Kw.-Hr. (10)	1937 System Peak Load (30-Minute) Incl. Purch. Energy Kw. (See Note a) (11)	1937 Peak Load on Generator Stations (30-Minute) Kw. (See Note a) (12)	1937 Generator Rating Kw. (13)	1937 Output for Year (Incl. Purch. Energy) Thousand Kw.-Hr. (14)	1936 System Peak Load (30-Minute) Incl. Purch. Energy Kw. (See Note a) (15)	1936 Peak Load on Generator Stations (30-Minute) Kw. (See Note a) (16)	1936 Generator Rating Kw. (17)	1936 Output for Year (Incl. Purch. Energy) Thousand Kw.-Hr. (18)	Line No. (19)
ited States																	
(C)	1,316,000	1,196,500	1,576,638	7,618,593	(o) 1,225,400	(o) 1,039,400	1,606,298	7,304,560	(o) 1,274,300	(o) 1,091,400	1,611,342	8,056,607	(o) 1,232,700	(o) 1,122,900	1,634,342	7,558,595	1
Co. and Subs. (D)	1,535,000	1,514,000	2,005,765	7,561,618	1,405,000	1,390,400	2,005,765	6,711,103	1,375,000	1,361,100	1,856,200	7,124,493	1,348,600	1,342,400	934,500	6,502,175	2
, of New York, Inc. (D)	1,660,000	1,669,000	2,566,300	7,376,854	1,645,000	1,585,500	2,566,300	6,714,417	1,507,500	1,459,000	2,346,200	6,538,147	1,449,000	1,446,000	2,376,200	6,038,990	3
Co	(k) 1,059,800		1,300,969	5,728,404	980,000		1,250,969	5,177,338	990,200		1,250,969	5,182,043	929,700		1,246,594	4,911,965	4
Co. (Central System)	909,320	921,620	1,128,826	4,759,531	803,135	800,180	993,267	4,072,081	(o) 822,460	(o) 794,600	1,013,257	4,780,963	(o) 800,120	(o) 769,945	961,719	4,430,935	5
o., System	(b) 907,000	(b) 936,000	1,126,125	4,253,421	837,000	862,000	1,127,125	3,849,519	789,000	834,000	1,097,375	3,833,949	(m) 831,000	(m) 837,000	1,102,375	3,606,749	6
ison Co., Ltd	(m) 684,500		1,096,170	3,618,199	(m) 579,000		931,550	3,058,175	(m) 580,500		931,550	3,138,654	(m) 645,400		903,640	3,492,532	7
& Gas Co	(k) 769,900	(k) 763,400	1,020,675	3,127,969	666,900	663,900	960,825	2,689,403	660,100	653,000	930,825	3,217,075	671,000	656,200	871,225	2,933,174	8
	700,800	644,900	737,700	2,994,947	623,400	588,000	737,700	2,678,396	575,650	519,000	684,450	2,747,123	582,225	502,750	684,450	2,531,677	9
	(m) 599,275			2,759,247	(m) 530,230			2,307,908	(m) 494,745			2,385,189	(m) 487,000			2,176,846	10
ority *	674,100	674,100	838,364	2,756,966	266,000	266,000	487,338	1,288,834	(o) 160,400	(o) 160,400	413,300	494,799	213,500	213,500	316,000	770,639	11
ng TVA Power (Consol. Rep't)				944,123													12
	589,490	476,490	579,879	2,596,828	(o) 465,700	(o) 441,700	579,879	2,132,738	(o) 505,900	(o) 496,900	579,744	2,347,861	491,900	410,500	578,762	2,261,068	13
(Boulder Dam)		(b) 589,200	704,800	2,507,932			539,800	1,522,627	319,200	319,200	370,000	1,166,681	162,000	162,000	247,500	120,884	14
sociation (Consolidated)	587,900	489,600	711,014	2,490,936	(o) 532,300	(o) 440,000	711,014	2,174,696	(o) 526,500		719,310	2,373,707	(o) 529,400		701,670	2,321,187	15
& Electric Co., Inc	473,097	465,697	627,800	2,470,563	(o) 409,558	(o) 401,218	618,579	2,136,864	(o) 432,759	(o) 411,600	590,679	2,543,471	(o) 416,392	(o) 399,342	506,323	2,405,317	16
Missouri and Subs	(m) 476,000	(m) 476,000	692,420	2,468,422	(m) 448,000	(m) 448,000	692,420	2,254,291	(m) 443,000	(m) 443,000	651,670	2,399,584	426,260		716,170	2,199,210	17
	427,300		381,939	2,050,359	(o) 374,400		382,114	1,758,406	(o) 361,100	(o) 291,100	384,624	1,870,625	(o) 342,900	(o) 330,780	383,094	1,642,301	18
	422,500	424,100	504,000	2,007,780	(o) 349,300	(o) 350,100	504,000	1,654,105	(o) 360,100	(o) 348,300	444,000	1,836,112		367,000	444,000	1,644,712	19
Light Co	379,956	314,400	391,689	1,874,595	(o) 360,300	(o) 302,902	391,689	1,752,164	345,000	266,800	392,189	1,778,250	(o) 348,800	(o) 262,200	355,532	1,730,569	20
Illuminating Co	416,900	416,900	523,750	1,820,146	(j) 387,214	(j) 387,214	527,500	1,548,630	(j) 360,223	(j) 362,223	477,500	1,707,031	353,868	354,868	477,500	1,641,551	21
	420,986		473,715	1,733,120	(o) 371,070		417,915	1,509,917	(o) 372,900	(o) 333,460	413,215	1,691,884	(o) 329,901	(o) 300,677	416,755	1,490,798	22
pt. of Water & Power	(k) 400,400	(k) 381,400	562,105	1,691,044	377,600	377,600	562,105	1,555,238	366,500	366,500	562,105	1,506,171	(m) 230,300	(m) 221,300	258,105	928,501	23
t & Power Co., Baltimore	(e) 307,000	215,000	250,950	(g) 1,646,037	(e) 276,000	(o) 142,000	230,950	(g) 1,430,008	(e) 300,000	(o) 144,000	230,950	(g) 1,508,886	(e) 285,200	(o) 167,000	230,950	(g) 1,328,131	24
ic Corp. and Subs. (D)	383,300		511,750	1,572,309	345,600		476,750	1,399,199	324,200		406,750	1,510,463	308,000		381,750	1,438,882	25
er Co., and Affil. Cos. (D)	(m) 356,553		(p) 547,480	1,550,252	317,740		(p) 530,740	1,424,858	343,061		531,714	1,506,345	300,976		517,444	1,366,641	26
	275,400	275,400	342,000	1,491,796	(o) 236,500	(o) 236,500	350,000	1,295,283	(o) 258,500	(o) 255,500	294,000	1,559,436	243,300	243,300	294,000	1,496,867	27
Co. (Minn.) and Sub	(m) 329,575	(m) 326,575	456,661	1,461,401	(m, s) 299,459	(m, s) 294,609	460,611	1,341,865	278,374		420,151	1,319,245		(s) 252,534	435,986	1,246,345	28
	372,590	323,265	389,160	1,453,365	(m) 336,995	(m) 293,210	359,160	1,203,804	(m) 305,430	(m) 249,040	359,160	1,274,633	(m) 320,966	(m) 278,000	358,910	1,266,045	29
afe Harbor W. P. Corp	332,000	332,000	311,000	1,319,195	(o) 335,000	(o) 335,000	311,000	1,548,165	(o) 335,500	(o) 335,500	311,000	1,848,643	(o) 334,000	(o) 334,000	311,000	1,320,075	30
	243,400	229,100	333,450	1,189,132	(o) 227,300	(o) 224,600	333,450	1,078,285	(o) 243,100	(o) 236,000	313,450	1,280,943	(o) 227,700	(o) 220,800	313,450	1,128,925	31
Co	(m) 249,310	(m) 228,160	315,185	1,155,039	(m) 233,170	(m) 228,170	315,245	1,047,416	(m) 232,410	(m) 230,635	319,745	1,233,901	(m) 219,240	(m) 214,440	314,245	1,044,906	32
Power Co. (v)	189,600	182,400	203,534	1,033,419	(o) 182,100	(o) 182,100	203,534	980,407	(o) 228,200	(o) 193,800	203,534	(e) 1,278,809	(o) 189,700	(o) 178,840	145,060	1,005,193	33
Co	218,000	201,000	255,000	993,139	(o) 198,000	(o) 178,000	255,000	910,962	(o) 189,000	(o) 154,000	220,000	835,168	(t) 179,000	(u) 152,000	220,000	778,927	34
	170,010	145,910	240,177	940,498	(o) 150,440	(o) 125,730	240,177	762,765	147,200	133,630	241,142	919,184	143,260	126,880	242,032	736,702	35
ic & Gas Corp. (D)	(l)	(l)	124,283	939,302	179,840	87,565	122,710	876,706	(o) 171,837	(o) 84,100	103,445	819,824	(o) 157,400	(o) 105,010	103,826	726,324	36
t Co	255,820	196,400	249,050	923,281	(o) 245,540	(o) 194,860	249,050	890,938	(o) 273,280	(o) 198,320	249,050	1,035,987	(o) 236,160	(o) 196,040	249,050	1,045,704	37
ndiana	(k) 179,280	(k) 139,500	133,520	859,706	164,730	134,700	133,520	736,972	158,650	117,500	136,520	774,931	152,560	114,500	124,720	764,850	38
ic Service Co	(k) 159,196	(k) 82,436	115,455	799,316	141,494	82,405	111,455	707,746	137,610	82,300	91,455	811,820	123,210	82,470	83,735	603,143	39
Light Co	(c, m) 148,800	(c, m) 148,800	283,925	782,861	(c, m) 143,400	(c, m) 143,400	277,925	749,787	151,700	151,700	263,211	757,407	135,100	135,100	255,793	721,326	40
& Power Co	174,231	147,549	194,625	780,108	(o) 154,070	(o) 127,435	194,865	670,029	154,872	129,935	196,815	748,186	(o) 149,504	(o) 124,443	169,815	700,104	41
wer Co	170,500	172,400	171,535	774,282	(o) 142,700	(o) 141,800	171,535	679,448	(o) 133,200	(o) 133,900	173,035	664,860	(o) 127,600	(o) 127,300	169,450	605,218	42
	110,225	103,110	102,410	766,549	(o) 106,821	(o) 101,935	102,135	657,375	92,302	(o) 86,085	100,985	609,466	(o) 81,797	(o) 78,667	83,345	517,962	43
ht Co	115,000	96,000	86,868	745,302	109,075	96,000	86,868	654,876		96,000	86,874	760,703	113,262	96,000	86,874	793,819	44
ric Co	171,000	144,000	183,465	744,545	(o) 152,000	(o) 140,000	183,465	676,706	(o) 144,000	(o) 140,000	183,000	704,759	(o) 145,000	(o) 141,000	168,690	659,643	45
wer Co	147,600	146,700	206,586	740,275	(o) 130,400	(o) 129,100	181,586	684,906	(o) 121,200	(o) 117,300	181,586	659,912	(o) 110,000	(o) 110,400	181,586	591,679	46
o.*	158,700	149,800	190,928	733,497	214,300	169,000	246,198	797,956	(o) 186,300	(o) 174,400	246,198	952,593	(o) 176,300	(o) 163,300	246,198	867,951	47
	118,028	117,610	181,516	724,664	97,959	97,506	148,016	598,534	(o) 70,441	(o) 70,019	75,596	367,401	(o) 58,330	(o) 56,955	75,691	292,270	48
e Co	143,400	106,600	129,100	655,688	116,800	90,400	129,600	530,560	129,100	97,900	125,100	624,774	111,800	100,200	127,600	577,089	49
ric Co	(b) 125,276	(b) 121,320	(y) 170,176	652,459	122,336	120,452	173,476	642,904	125,096	124,104	173,676	691,821		97,689	159,796	588,952	50
Co	133,450	107,750	96,940	638,047	(o) 127,400	(o) 104,620	98,431	604,559	(o) 125,610	(o) 104,480	98,616	588,397	(o) 112,850	(o) 101,680	98,571	535,205	51
Power Co	114,955	111,855	115,080	600,284	105,135	105,135	115,080	565,815	110,980	106,175	115,430	575,585		106,252	115,430	553,827	52
Light Co	114,700	121,000	165,500	571,449	102,000	106,200	165,500	372,734	100,700	103,300	125,500	242,016	102,300	90,800	124,750	475,956	53
Co	109,300	108,400	133,097	565,112	103,752	103,452	125,922	521,477	101,900	100,200	125,922	536,254	104,660		127,062	512,988	54
	147,940	140,940	180,280	553,179	130,940	113,840	180,280	474,081	116,020	108,020	177,380	551,993	109,000	98,000	171,780	523,217	55
Co	109,200	50,000	52,100	548,761	(o) 105,400	(o) 56,700	52,100	421,490	(o) 82,600	(o) 51,200	52,100	439,684	75,786		52,100	384,310	56
upply, (San Francisco)	84,700	84,700	83,000	525,993	87,800	87,800	83,000	531,402	87,700	87,700	83,300	506,712	83,500	83,500	83,300	514,179	57
Light Co	(k) 123,300	(k) 123,300	184,000	522,327	104,900	104,700	175,700	456,598	110,000	110,000	165,200	472,852	94,750	83,750	166,700	421,305	58
Colorado	108,638	107,440	157,482	499,674	(o) 101,480	(o) 99,920	155,162	481,374	(o) 95,310	(o) 94,000	126,562	472,369	(o) 89,690	(o) 88,260	131,512	416,804	59
ht Co	96,000	77,000	107,998	496,709	(o) 93,200	(o) 68,000	108,004	459,924	88,541	69,400	108,514	452,466	(o) 81,700	(o) 68,000	99,904	391,061	60
Se																	
54 Central Maine Power Co	109,300	108,400	133,097	565,112	103,752	103,452	125,922	521,477	101,900	100,200	125,922	536,254	104,660	90,800	127,062	512,988	

54	Central Maine Power Co		109,300		108,400		133,097		565,112		105,752		103,452		125,922		521,477		101,900		100,200		125,922		536,254		104,660			
55	The Toledo Edison Co		147,940		140,940		180,280		553,179		130,940		113,840		180,280		474,081		116,020		108,020		177,380		551,993		109,000		98,000	
56	Northwestern Electric Co		109,200		50,000		52,100		548,761	(o)	105,400	(o)	56,700		52,100		421,490	(o)	82,600	(o)	51,200		52,100		439,684		75,786			
57	Hetch Hetchy Water Supply, (San Francisco)		84,700		84,700		83,000		525,993		87,800		87,800		83,000		531,402		87,700		87,700		83,300		506,712		83,500		83,500	
58	Indianapolis Power & Light Co	(k)	123,300	(k)	123,300		184,000		522,327		104,900		104,700		175,700		456,598		110,000		110,000		165,200		472,852		94,750		83,750	
59	Public Service Co., of Colorado		108,638		107,440		157,482		499,674	(o)	101,480	(o)	99,920		155,162		481,374	(o)	95,310	(o)	94,000		126,562		472,369	(o)	89,690	(o)	88,260	
60	Arkansas Power & Light Co		96,000		77,000		107,998		496,709	(o)	93,200	(o)	68,000		108,004		459,924		88,541		69,400		108,514		452,466	(o)	81,700	(o)	68,000	
61	Central Illinois Public Service Co		128,200		71,700		75,000		491,175		112,800		69,900		75,000		461,301		112,400		65,400		75,000		459,167		106,500		63,400	
62	Western Massachusetts Companies		100,400				160,050		484,636		88,800				160,050		472,089	(o)	86,000				160,750		494,773		91,000			
63	Texas Electric Service Co		109,962		98,321		98,126		479,421	(o)	102,224	(o)	93,102		98,126		470,263	(o)	83,988	(o)	83,369		98,078		477,809	(o)	88,422	(o)	87,900	
64	Louisville Gas & Electric Co., (Ky.) and Subs	(m)	104,530	(m)	97,000		209,820		477,665	(m)	99,530	(m)	99,500		209,820		448,947	(m)	109,030		109,000		191,320		434,964				126,330	
65	Rochester Gas and Electric Corp		108,174		103,050		163,350		472,093	(o)	93,109	(o)	85,760		163,350		444,889	(o)	95,803	(o)	86,560		138,435		461,273	(o)	87,179		71,700	
66	New Orleans Public Service Inc		96,000		107,000		138,000		470,042		84,000		96,000		138,000		421,447	(r)	85,000	(r)	105,000		108,000		444,434		96,000		96,000	
67	City of Seattle—Department of Lighting	(m)	113,000	(m)	136,000		239,000		469,701	(m)	111,000	(m)	111,000		239,000		439,541	(m)	103,000	(m)	103,000		239,000		419,977	(m)	104,000		104,000	
68	Montaup Electric Co		107,600		76,500		75,000		466,829		103,500		76,800		75,000		407,600		101,900		74,650		75,000		368,319					
69	Columbus & Southern Ohio Electric Co		97,600		97,600		183,350		456,361	(f)	84,900	(f)	84,900		153,475		413,516	(o)	81,000	(o)	81,000		153,475		419,604	(o)	78,700	(o)	78,700	
70	Kentucky Utilities Co., (Consolidated) (D)		88,000		73,200		103,240		437,959		84,600		61,800		78,990		371,503		65,900		51,400		72,950		360,061		64,300		52,600	
71	Minnesota Power & Light Co		91,758		91,758		125,331		436,353	(o)	87,341	(o)	87,341		125,331		402,417	(o)	93,208	(o)	93,208		125,331		460,171	(o)	90,341	(o)	90,341	
72	Florida Power & Light Co		120,198		119,628		139,028		418,945	(o)	107,984	(o)	107,604		139,068		369,724	(o)	93,800	(o)	93,470		139,033		341,281	(o)	83,120	(o)	82,740	
73	City of Tacoma, Dept. of Public Utilities		84,000		84,000		148,000		417,408		73,000		73,000		148,000		344,818	(o)	69,000	(o)	78,000		158,000		374,838	(o)	62,000	(o)	71,000	
74	The Nevada-California Electric Corp		74,400		43,700		59,010		416,921		79,400		72,000		101,260		458,286		77,800		74,200		101,435		439,237		74,400		58,300	
75	Nebraska Power Co		84,200		83,300		111,750		413,803	(o)	78,600	(o)	78,600		111,500		389,728	(o)	81,600	(o)	81,600		106,500		397,621			(m)	81,500	
76	The United Illuminating Co			(h)	101,100		160,000		409,369	(m, h)	94,900	(m, h)	94,900		160,000		347,708			(h)	86,900		160,000		372,354			(o, h)	87,600	
77	Pennsylvania Electric Co	(h)	107,640	(h)	106,440		57,100		397,671		92,200		90,200		146,675		439,914		91,150		90,070		146,675		475,274	(o)	88,560	(o)	88,160	
78	Wisconsin Public Service Corp. (D)		73,440		73,440		106,686		389,668		66,500		66,500		109,061		339,648	(o)	64,888	(o)	64,888		89,221		317,890				65,400	
79	Long Island Lighting System	(b)	113,000	(b)	113,000		239,100		389,103		104,000		104,000		238,100		365,929		97,200		97,200		166,500		339,369		86,500		86,500	
80	Central Illinois Light Co	(m)	84,445	(m)	83,295		113,500		388,871	(o)	75,346	(m)	74,570		88,500		343,762	(o)	77,716	(m)	76,300		88,500		381,249	(o)	73,005	(o)	75,900	
81	Salt River Valley Water Users' Assn						80,950		362,509	(m)	76,800	(m)	76,800		80,050		419,781	(o)	110,475	(o)	68,975		70,050		496,414		82,000		67,000	
82	Virginia Public Service Co		84,100		83,800		98,508		356,725		68,800		66,900		97,668		311,106	(o)	61,200	(o)	58,600		98,688		294,871	(o)	67,900	(o)	66,500	
83	Jersey Central Power & Light Co		82,300		87,100		137,650		350,150		74,300		74,900		137,650		314,262		69,200		74,500		137,650		312,040	(m)	66,000	(m)	70,000	
84	Wisconsin Power & Light Co		76,300		73,430		90,195		347,846		72,510		69,365		88,265		329,252		70,100		68,750		86,265		326,457		67,950		65,975	
85	Atlantic City Electric Co		74,900		74,900	(p)	120,000		347,127	(o)	71,600	(o)	71,600		120,000		304,348	(o)	68,500	(o)	68,500		120,000		296,238	(o)	62,100	(o)	62,100	
86	Dallas Power & Light Co		78,000		78,000		113,750		344,227	(o)	72,000	(o)	72,000		113,750		319,772	(o)	68,000	(o)	68,000		82,500		308,008	(o)	78,300	(o)	78,300	
87	South Carolina Electric & Gas Co.*		97,500		90,400	(y)	90,630		333,564		205,000		197,000		227,130		439,485	(o)	139,700	(o)	139,700		227,100		484,269	(o)	137,700	(o)	137,700	
88	Birmingham Electric Co		66,241				11,300		332,958	(o)	59,401				11,300		302,477	(o)	56,198				11,300		304,740		52,588			
89	Central Power & Light Co		65,960		53,660		76,503		320,905		60,600				75,943		297,919		60,820		50,255		76,183		287,744		49,205		9,150	
90	Public Service Co. of New Hampshire		73,250		70,100		126,444		313,592	(o)	68,250	(o)	66,400		127,369		268,618	(o)	62,905	(o)	60,805		107,009		278,351	(o)	60,040	(o)	59,940	
91	The Connecticut Power Co	(s)	42,500				49,340		312,764						49,460		283,829						49,500		312,502					
92	Southwestern Gas & Electric Co		53,358		47,700		55,515		311,909	(o)	49,725				59,265		305,528		49,762		34,100		44,265		296,354		41,500		33,700	
93	Pennsylvania Edison Co		70,800		66,760		80,200		311,603		58,505		57,405		80,200		277,041	(o)	66,700	(o)	66,600		80,200		301,486	(o)	61,650	(o)	61,600	
94	Central Hudson Gas & Electric Corp		71,700	(d)	66,000		35,480		306,432	(o)	52,800	(d, o)	49,800		35,480		253,631	(o)	48,600	(d, o)	46,500		55,000		244,549	(o)	59,900	(d, o)	41,600	
95	The Scranton Electric Co		85,100		85,100	(p)	117,700		305,819	(o)	69,000	(o)	69,000		117,700		284,482	(o)	59,700	(o)	59,700		117,700		299,760	(o)	59,800	(o)	59,800	
96	Kansas Gas & Electric Co		63,500		63,400		89,000		305,033	(o)	59,200	(o)	59,200		89,000		305,724	(o)	57,500	(o)	57,300		66,000		319,946		57,000		57,000	
97	Public Service Co., of Okla		63,700		57,000		99,241		291,687		59,600		52,000		99,436		265,968		55,000		48,500		76,580		272,179		48,300		43,000	
98	Lexington Water Power Co.*		116,000		116,000		130,000		289,792																					
99	Pacific Power & Light Co		59,490				31,817		283,301	(o)	56,880				31,817		279,592	(m)	54,550				30,567		320,128		48,940			
100	West Texas Utilities Co		54,750		49,650		52,442		274,473	(o)	51,650				52,942		272,091		54,900				53,162		293,348		50,200			
101	Northern Indiana Power Co	(k)	57,860	(k)	10,720		17,384		272,027		51,840		400		22,384		224,805		47,390		7,500		23,384		227,974		43,820		7,400	
102	The Empire District Electric Co	(m)	54,300	(m)	54,300		93,220		268,237	(m)	51,800	(m)	51,800		93,220		262,896	(m)	57,400	(m)	57,400		143,420		310,102	(m)	52,200	(m)	52,200	
103	San Diego Consolidated Gas & Electric Co	(b)	72,600	(b)	72,500		99,000		264,027		64,550		62,500		99,000		248,639		59,800		56,800		74,000		235,657		56,500		59,500	
104	San Antonio Public Service Co		57,673		57,600		99,400		260,411	(o)	56,372	(o)	56,300		99,400		244,164		59,629		53,729		99,000		231,222	(o)	54,948			
105	Pennsylvania Power Co		53,400		39,200		37,500		255,017	(o)	45,000				2,500		207,993	(o)	51,870				2,500		264,098	(o)	45,000			
106	Des Moines Electric Light Co				55,000		107,400		244,459		61,900		61,900		72,500		246,121		54,000		54,000		74,300		244,105				50,000	
107	Sioux City G. & El. Co.,—Iowa P. S. Co. System		54,513		47,547		89,997		242,027	(o)	55,828	(o)	47,745		88,497		250,983		51,010		48,735		78,116		214,236		48,000	(o)	46,200	
108	Inland Power & Light Co		51,575		51,575		45,800		240,854	(o)	51,200	(o)	51,200		45,800		237,574	(o)	51,560	(o)	51,560		45,800		267,172		50,615		50,615	
109	Mississippi Power & Light Co		51,600		4,700		15,170		239,128	(o)	59,755	(o)	7,268		15,170		240,306	(o)	49,459	(o)	5,560		15,968		219,639	(o)	43,189	(o)	7,590	
110	New Bedford Gas & Edison Light Co		57,900		57,900		92,000		237,308		48,600		48,600		92,000		186,313	(o)	56,800	(o)	56,800		92,000		226,963	(o)	52,500	(o)	52,500	
111	Blackstone Valley Gas & Electric Co		52,885				35,350		232,342	(o)	52,759	(o)	21,230		35,350		196,378	(o)	54,488	(o)	33,560		35,350		214,399		53,749	(o)	23,960	
112	Florida Power Corp		60,900		54,300		58,824		226,405		52,100		41,000		58,754		181,886	(o)	43,100	(o)	42,100		58,567		180,210	(o)	30,500	(o)	23,000	
113	Delaware Power & Light Co		45,288		5,000		22,500		220,707	(o)	38,928	(o)	4,000		22,500		195,301	(o)	37,810	(o)	11,500		22,500		203,499		35,034			
114	City of Detroit Public Lighting Commission		53,000		50,250		80,000		212,642		68,000		63,000		80,000		214,375	(x)	53,000	(x)	48,000		80,000	(x)	219,995		56,605		52,150	
115	The Sanitary District of Chicago		42,060		24,325		35,000		211,366		41,341		23,200		35,000		216,396	(o)	40,130	(o)	22,967		35,000		212,568		40,300		22,800	
116	Cumberland County Power & Light Co		47,140		26,140		66,075		210,056		43,940		29,240		68,662		190,467	(o)	42,280	(o)	26,280		61,172		213,039	(o)	45,720	(o)	31,720	
117	New Jersey Power & Light Co.*		85,000		53,000		55,270		204,602																					
118	Iowa Electric Light & Power Co		50,000		50,000		60,263		204,019		43,191		43,191		56,963		189,270		40,922		40,922		63,113		178,822		38,462		38,462	
119	Interstate Power Co		56,492		46,033		73,919		203,360		49,959		41,773		73,699		182,594		46,707		38,052		71,818		184,787		44,447		35,492	
120	Indiana Service Corp		47,200		28,100		31,000		198,243	(m)	42,600	(m)	22,600		31,000		165,343		46,100		24,000		31,000		201,481		41,200		27,000	
121	Mississippi Power Co		40,939		6,900		17,490		196,509	(o)	33,772	(o)	5,700		18,702		174,259	(o)	33,397	(o)	5,900		18,702		174,344	(o)	29,455	(o)	5,500	
122	Tampa Electric Co		48,800		41,400		42,500		187,584		43,800		42,500		42,500		171,654		39,400		38,400		42,500		176,837		35,000		35,000	
123	Mountain States Power Co						22,541		185,843																					
124	City of Cleveland, Dept. of Public Utilities		42,150		42,150		50,000		183,260		40,800		40,800		50,000		170,232		41,000		41,000		50,000		205,752		42,400		42,400	
125	South Carolina Power Co		35,100				42,170	(p)	181,780	(o)	31,600	(o)	26,700		41,370		160,707	(o)	29,000	(o)	29,000		41,732		163,881	(o)	30,800	(o)	25,700	
126	Turlock-Modesto Irrigation Districts		38,500		38,500		35,000		180,077		40,700		40,700		35,000		193,628	(o)	40,560	(o)	40,560		35,000		174,312		39,560		39,560	
127	Rumford Falls Power Co	(m)	29,600	(m)	29,600		28,400		172,836	(m)	30,000	(m)	30,000		28,350		182,500													
128	Jacksonville Municipal Light Plant	(m)	38,000		38,000		81,500		159,286		34,100		34,100		54,500		138,415		31,800		31,800		54,500		134,730			(m)	30,900	
129	Kansas City, Kan. Board of Public Utilities		32,600		32,600		69,000		155,988	(o)	30,500	(o)	30,500		69,000		147,814	(o)	29,400	(o)	29,400		39,000		144,708	(o)	27,500	(o)	27,500	
130	Iowa-Nebraska Light & Power Co		37,105		31,640		47,335		155,764	(o)	35,990	(o)	31,280		47,335		146,723	(o)	34,200	(o)	28,180		45,450		144,924	(o)	32,600			
131	Laclede Power & Light Co				36,400		46,500		155,085		33,400		33,400		48,500		146,657	(m)	32,200	(m)	26,000		33,500		140,282					
132	Engineer Dept., U. S. Army (Bonneville)		90,000		90,000		86,400		151,770																					
133	Southern Indiana Gas & Electric Co		34,000		34,000		62,800		149,787	(o)	33,500	(o)	33,500		67,800		130,435	(o)	35,500	(o)	35,500		50,900		143,260	(o)	34,200	(o)	34,200	
134	El Paso Electric Co		32,000		32,000		56,529		143,289		28,900		28,900		56,529		135,757		26,600		26,600		56,529		127,294		26,200		26,200	
135	Washington Gas & Electric Co		29,300		27,000		27,125		140,945		27,420				27,125		124,198		39,697		27,291		27,050		138,952		27,800		25,500	
136	Staten Island Edison Corp		36,731		37,300		46,000		140,801		33,700		33,400		47,500		127,392	(o)	31,700	(o)	31,700		47,500		130,148	(o)	31,000	(o)	30,600	
137	City of Lansing Bd. of Wtr. & Elec. Lt. Comm'rs		38,952		38,952		59,950		140,099		36,970		36,970		56,200		115,392		37,271		37,271		56,200		139,612		32,930		32,930	
138	Central Arizona Light & Power Co		34,400		34,500		28,000		135,858	(o)	33,100	(o)	32,100		28,000		133,631		31,300		19,400		15,000		125,061		23,000		19,400	
139	Luzerne County Gas & Electric Corp		26,140		44,200		55,000		133,862	(o)	25,180	(o)	41,400		55,000		130,017	(o)	26,470	(o)	44,670		55,000		139,909	(o)	27,600	(o)	40,800	
140	Central Illinois Electric & Gas Co	(k)	30,120				47,438		133,080		25,950				47,438		116,378		27,700				47,438		128,607		26,100			
141	Cambridge Electric Light Co		34,270		23,400		22,750		132,440		33,600		19,400		23,950		121,182	(o)	29,000	(o)	22,100		23,950		119,020	(o)	30,364	(o)	25,600	
142	Bangor Hydro-Electric Co		32,030		32,030		35,960		130,912				26,660		33,460		125,652	(o)	24,460	(o)	24,460		31,035		136,455	(o)	26,040	(o)	26,040	
143	The Marion-Reserve Power Co				16,200		27,000		129,324																					
144	Iowa Southern Utilities Co		26,700		16,600		25,107		118,406		26,700		15,000		25,107		113,299		23,000		15,000		25,107		118,064		24,000		11,000	

ght Co		114,700		121,000		103,500		5,145		100,600		100,200		15,500		28,700		45,107		113,799		23,000		15,000		25,107		118,064		24,000		11,000	
		109,300		108,400		133,097		565,112		103,752		103,452		125,922		521,477		101,900		100,200		125,922		536,254		104,660		127,062		512,988		54	
		147,940		140,940		180,280		553,179		130,940		113,840		180,280		474,081		116,020		108,020		177,380		551,993		109,000		98,000		171,780		523,217		55
o		109,200		50,000		52,100		548,761	(o)	105,400	(o)	56,700		52,100		421,490	(o)	82,600	(o)	51,200		52,100		439,684		75,786				52,100		384,310		56	
pply, (San Francisco)		84,700		84,700		83,000		525,993		87,800		87,800		83,000		531,402		87,700		87,700		83,300		506,712		83,500		83,500		83,300		514,179		57	
ght Co	(k)	123,300	(k)	123,300		184,000		522,327		104,900		104,700		175,700		456,598		110,000		110,000		165,200		472,852		94,750		83,750		166,700		421,305		58	
olorado		108,638		107,440		157,482		499,674	(o)	101,480	(o)	99,920		155,162		481,374	(o)	95,310	(o)	94,000		126,562		472,369	(o)	89,690	(o)	88,260		131,512		416,804		59	
Co		96,000		77,000		107,998		496,709	(o)	93,200	(o)	68,000		108,004		459,924		88,541		69,400		108,514		452,466	(o)	81,700	(o)	68,000		99,904		391,061		60	
ervice Co		128,200		71,700		75,000		491,175		112,800		69,900		75,000		461,301		112,400		65,400		75,000		459,167		106,500		63,400		81,140		421,145		61	
Companies		100,400				160,050		484,636		88,800				160,050		472,089	(o)	86,000				160,750		494,773		91,000				151,825		461,609		62	
o		109,962		98,321		98,126		479,421	(o)	102,224	(o)	93,102		98,126		470,263	(o)	83,988	(o)	83,369		98,078		477,809	(o)	88,422	(o)	87,900		98,302		401,644		63	
Co., (Ky.) and Subs	(m)	104,530	(m)	97,000		209,820		477,665	(m)	99,530	(m)	99,500		209,820		448,947	(m)	109,030		109,000		191,320		434,964				126,330		192,340		475,854		64	
ric Corp		108,174		103,050		163,350		472,093	(o)	93,109	(o)	85,760		163,350		444,889	(o)	95,803	(o)	86,560		138,435		461,273	(o)	87,179		71,700		132,620		415,012		65	
rice Inc		96,000		107,000		138,000		470,042		84,000		96,000		138,000		421,447	(r)	85,000	(r)	105,000		108,000		444,434		96,000		96,000		108,000		416,139		66	
ment of Lighting	(m)	113,000	(m)	136,000		239,000		469,701	(m)	111,000	(m)	111,000		239,000		439,541	(m)	103,000	(m)	103,000		239,000		419,977	(m)	104,000		104,000		119,000		387,637		67	
		107,600		76,500		75,000		466,829		103,500		76,800		75,000		407,600		101,900		74,650		75,000		368,319										68	
hio Electric Co		97,600		97,600		183,350		456,361	(f)	84,900	(f)	84,900		153,475		413,516	(o)	81,000	(o)	81,000		153,475		419,604	(o)	78,700	(o)	78,700		132,500		361,293		69	
(Consolidated) (D)		88,000		73,200		103,240		437,959		84,600		61,800		78,990		371,503		65,900		51,400		72,950		360,061		64,300		52,600		71,790		352,544		70	
t Co		91,758		91,758		125,331		436,353	(o)	87,341	(o)	87,341		125,331		402,417	(o)	93,208	(o)	93,208		125,331		460,171	(o)	90,341	(o)	90,341		125,331		459,591		71	
Co		120,198		119,628		139,028		418,945	(o)	107,984	(o)	107,604		139,068		369,724	(o)	93,800	(o)	93,470		139,033		341,281	(o)	83,120	(o)	82,740		139,033		294,291		72	
f Public Utilities		84,000		84,000		148,000		417,408		73,000		73,000		148,000		344,818	(o)	69,000	(o)	78,000		158,000		374,838	(o)	62,000	(o)	71,000		148,000		312,663		73	
Electric Corp		74,400		43,700		59,010		416,921		79,400		72,000		101,260		458,286		77,800		74,200		101,435		439,237		74,400		58,300		68,982		400,128		74	
		84,200		83,300		111,750		413,803	(o)	78,600	(o)	78,600		111,500		389,728	(o)	81,600	(o)	81,600		106,500		397,621			(m)	81,500		96,500		393,795		75	
Co			(h)	101,100		160,000		409,369	(m, h)	94,900	(m, h)	94,900		160,000		347,708			(h)	86,900		160,000		372,354			(o, h)	87,600		160,000		349,324		76	
	(h)	107,640	(h)	106,440		57,100		397,671		92,200		90,200		146,675		439,914		91,150		90,070		146,675		475,274	(o)	88,560	(o)	88,160		141,675		440,969		77	
Corp. (D)		73,440		73,440		106,686		389,668		66,500		66,500		109,061		339,648	(o)	64,888	(o)	64,888		89,221		317,890				65,400		88,896		297,258		78	
stem	(b)	113,000	(b)	113,000		239,100		389,103		104,000		104,000		238,100		365,929		97,200		97,200		166,500		339,369		86,500		86,500		132,150		308,572		79	
	(m)	84,445	(m)	83,295		113,500		388,871	(o)	75,346	(m)	74,570		88,500		343,762	(o)	77,716	(m)	76,300		88,500		381,249	(o)	73,005	(o)	75,900		88,500		356,041		80	
Users' Assn						80,950		362,509	(m)	76,800	(m)	76,800		80,050		419,781	(o)	110,475	(o)	68,975		70,050		496,414		82,000		67,000		70,050		370,930		81	
Co		84,100		83,800		98,508		356,725		68,800		66,900		97,668		311,106	(o)	61,200	(o)	58,600		98,688		294,871	(o)	67,900	(o)	66,500		98,513		280,473		82	
Light Co		82,300		87,100		137,650		350,150		74,300		74,900		137,650		314,262		69,200		74,500		137,650		312,040	(m)	66,000	(m)	70,000		141,650		271,993		83	
t Co		76,300		73,430		90,195		347,846		72,510		69,365		88,265		329,252		70,100		68,750		86,265		326,457		67,950		65,975		86,827		309,384		84	
		74,900		74,900	(p)	120,000		347,127	(o)	71,600	(o)	71,600		120,000		304,348	(o)	68,500	(o)	68,500		120,000		296,238	(o)	62,100	(o)	62,100		120,000		268,396		85	
		78,000		78,000		113,750		344,227	(o)	72,000	(o)	72,000		113,750		319,772	(o)	68,000	(o)	68,000		82,500		308,008	(o)	78,300	(o)	78,300		82,500		290,990		86	
& Gas Co.*		97,500		90,400	(y)	90,630		333,564		205,000		197,000		227,130		439,485	(o)	139,700	(o)	139,700		227,100		484,269	(o)	137,700	(o)	137,700		227,130		461,609		87	
		66,241				11,300		332,958	(o)	59,401				11,300		302,477	(o)	56,198				11,300		304,740		52,588				11,700		279,557		88	
Co		65,960		53,660		76,503		320,905		60,600				75,943		297,919		60,820		50,255		76,183		287,744		49,205		9,150		76,195		239,433		89	
w Hampshire		73,250		70,100		126,444		313,592	(o)	68,250	(o)	66,400		127,369		268,618	(o)	62,905	(o)	60,805		107,009		278,351	(o)	60,040	(o)	59,940		104,322		240,785		90	
Co	(s)	42,500				49,340		312,764						49,460		283,829						49,500		312,502						59,785		276,762		91	
ctric Co		53,358		47,700		55,515		311,909	(o)	49,725				59,265		305,528		49,762		34,100		44,265		296,354		41,500		33,700		47,476		248,514		92	
		70,800		66,760		80,200		311,603		58,505		57,405		80,200		277,041	(o)	66,700	(o)	66,600		80,200		301,486	(o)	61,650	(o)	61,600		80,200		291,435		93	
Electric Corp		71,700	(d)	66,000		35,480		306,432	(o)	52,800	(d, o)	49,800		35,480		253,631	(o)	48,600	(d, o)	46,500		55,000		244,549	(o)	59,900	(d, o)	41,600		35,740		227,597		94	
o		85,100		85,100	(p)	117,700		305,819	(o)	69,000	(o)	69,000		117,700		284,482	(o)	59,700	(o)	59,700		117,700		299,760	(o)	59,800	(o)	59,800		117,700		316,188		95	
Co		63,500		63,400		89,000		305,033	(o)	59,200	(o)	59,200		89,000		305,724	(o)	57,500	(o)	57,300		66,000		319,946		57,000		57,000		66,000		299,415		96	
kla		63,700		57,000		99,241		291,687		59,600		52,000		99,436		265,968		55,000		48,500		76,580		272,179		48,300		43,000		78,080		241,977		97	
Co.*		116,000		116,000		130,000		289,792																										98	
o		59,490				31,817		283,301	(o)	56,880				31,817		279,592	(m)	54,550				30,567		320,128		48,940				30,567		256,712		99	
		54,750		49,650		52,442		274,473	(o)	51,650				52,942		272,091		54,900				53,162		293,348		50,200				53,162		275,227		100	
Co	(k)	57,860	(k)	10,720		17,384		272,027		51,840		400		22,384		224,805		47,390		7,500		23,384		227,974		43,820		7,400		23,384		199,081		101	
ctric Co	(m)	54,300	(m)	54,300		93,220		268,237	(m)	51,800	(m)	51,800		93,220		262,896	(m)	57,400	(m)	57,400		143,420		310,102	(m)	52,200	(m)	52,200		86,220		287,065		102	
Gas & Electric Co	(b)	72,600	(b)	72,500		99,000		264,027		64,550		62,500		99,000		248,639		59,800		56,800		74,000		235,657		56,500		59,500		74,000		231,925		103	
ice Co		57,673		57,600		99,400		260,411	(o)	56,372	(o)	56,300		99,400		244,164		59,629		53,729		99,000		231,222	(o)	54,948				98,500		204,457		104	
		53,400		39,200		37,500		255,017	(o)	45,000				2,500		207,993	(o)	51,870				2,500		264,098	(o)	45,000				2,500		227,998		105	
ht Co				55,000		107,400		244,459		61,900		61,900		72,500		246,121		54,000		54,000		74,300		244,105				50,000		74,300		225,006		106	
—Iowa P. S. Co. System		54,513		47,547		89,997		242,027	(o)	55,828	(o)	47,745		88,497		250,983		51,010		48,735		78,116		214,236		48,000	(o)	46,200		77,615		208,170		107	
Co		51,575		51,575		45,800		240,854	(o)	51,200	(o)	51,200		45,800		237,574	(o)	51,560	(o)	51,560		45,800		267,172		50,615		50,615		45,800		227,924		108	
ht Co		51,600		4,700		15,170		239,128	(o)	59,755	(o)	7,268		15,170		240,306	(o)	49,459	(o)	5,560		15,968		219,639	(o)	43,189	(o)	7,590		19,146		196,645		109	
ison Light Co		57,900		57,900		92,000		237,308		48,600		48,600		92,000		186,313	(o)	56,800	(o)	56,800		92,000		226,963	(o)	52,500	(o)	52,500		92,000		214,933		110	
& Electric Co		52,885				35,350		232,342	(o)	52,759	(o)	21,230		35,350		196,378	(o)	54,488	(o)	33,560		35,350		214,399		53,749	(o)	23,960		35,250		230,166		111	
		60,900		54,300		58,824		226,405		52,100		41,000		58,754		181,886	(o)	43,100	(o)	42,100		58,567		180,210	(o)	30,500	(o)	23,000		58,427		138,066		112	
t Co		45,288		5,000		22,500		220,707	(o)	38,928	(o)	4,000		22,500		195,301	(o)	37,810	(o)	11,500		22,500		203,499		35,034				22,500		172,131		113	
ighting Commission		53,000		50,250		80,000		212,642		68,000		63,000		80,000		214,375	(x)	53,000	(x)	48,000		80,000	(x)	219,995		56,605		52,150		80,000		215,382		114	
Chicago		42,060		24,325		35,000		211,366		41,341		23,200		35,000		216,396	(o)	40,130	(o)	22,967		35,000		212,568		40,300		22,800		31,000		200,947		115	
wer & Light Co		47,140		26,140		66,075		210,056		43,940		29,240		68,662		190,467	(o)	42,280	(o)	26,280		61,172		213,039	(o)	45,720	(o)	31,720		60,312		192,698		116	
ght Co.*		85,000		53,000		55,270		204,602																										117	
Power Co		50,000		50,000		60,263		204,019		43,191		43,191		56,963		189,270		40,922		40,922		63,113		178,822		38,462		38,462		59,203		167,054		118	
		56,492		46,033		73,919		203,360		49,959		41,773		73,699		182,594		46,707		38,052		71,818		184,787		44,447		35,492		69,497		173,233		119	
		47,200		28,100		31,000		198,243	(m)	42,600	(m)	22,600		31,000		165,343		46,100		24,000		31,000		201,481		41,200		27,000		31,000		184,776		120	
		40,939		6,900		17,490		196,509	(o)	33,772	(o)	5,700		18,702		174,259	(o)	33,397	(o)	5,900		18,702		174,344	(o)	29,455	(o)	5,500		18,453		146,009		121	
		48,800		41,400		42,500		187,584		43,800		42,500		42,500		171,654		39,400		38,400		42,500		176,837		35,000		35,000		35,000		163,243		122	
Co						22,541		185,843																										123	
t. of Public Utilities		42,150		42,150		50,000		183,260		40,800		40,800		50,000		170,232		41,000		41,000		50,000		205,752		42,400		42,400		50,000		184,834		124	
Co		35,100				42,170	(p)	181,780	(o)	31,600	(o)	26,700		41,370		160,707	(o)	29,000	(o)	29,000		41,732		163,881	(o)	30,800	(o)	25,700		36,332		138,394		125	
tion Districts		38,500		38,500		35,000		180,077		40,700		40,700		35,000		193,628	(o)	40,560	(o)	40,560		35,000		174,312		39,560		39,560		35,000		158,258		126	
o	(m)	29,600	(m)	29,600		28,400		172,836	(m)	30,000	(m)	30,000		28,350		182,500																		127	
Light Plant	(m)	38,000		38,000		81,500		159,286		34,100		34,100		54,500		138,415		31,800		31,800		54,500		134,730			(m)	30,900		54,500		117,319		128	
rd of Public Utilities		32,600		32,600		69,000		155,988	(o)	30,500	(o)	30,500		69,000		147,814	(o)	29,400	(o)	29,400		39,000		144,708	(o)	27,500	(o)	27,500		39,000		135,366		129	
Power Co		37,105		31,640		47,335		155,764	(o)	35,990	(o)	31,280		47,335		146,723	(o)	34,200	(o)	28,180		45,450		144,924	(o)	32,600				43,503		141,706		130	
Co				36,400		46,500		155,085		33,400		33,400		48,500		146,657	(m)	32,200	(m)	26,000		33,500		140,282										131	
rmy (Bonneville)		90,000		90,000		86,400		151,770																										132	
& Electric Co		34,000		34,000		62,800		149,787	(o)	33,500	(o)	33,500		67,800		130,435	(o)	35,500	(o)	35,500		50,900		143,260	(o)	34,200	(o)	34,200		50,900		128,476		133	
		32,000		32,000		56,529		143,289		28,900		28,900		56,529		135,757		26,600		26,600		56,529		127,294		26,200		26,200		56,529		117,178		134	
tric Co		29,300		27,000		27,125		140,945		27,420				27,125		124,198		39,697		27,291		27,050		138,952		27,800		25,500		24,000		135,884		135	
orp		36,731		37,300		46,000		140,801		33,700		33,400		47,500		127,392	(o)	31,700	(o)	31,700		47,500		130,148	(o)	31,000	(o)	30,600		47,500		122,722		136	
Wtr. & Elec. Lt. Comm'rs		38,952		38,952		59,950		140,099		36,970		36,970		56,200		115,392		37,271		37,271		56,200		139,612		32,930		32,930		66,700		121,838		137	
& Power Co		34,400		34,500		28,000		135,858	(o)	33,100	(o)	32,100		28,000		133,631		31,300		19,400		15,000		125,061		23,000		19,400		15,500		106,533		138	
Electric Corp		26,140		44,200		55,000		133,862	(o)	25,180	(o)	41,400		55,000		130,017	(o)	26,470	(o)	44,670		55,000		139,909	(o)	27,600	(o)	40,800		55,000		142,525		139	
& Gas Co	(k)	30,120				47,438		133,080		25,950				47,438		116,378		27,700				47,438		128,607		26,100				44,938		117,906		140	
ht Co		34,270		23,400		22,750		132,440		33,600		19,400		23,950		121,182	(o)	29,000	(o)	22,100		23,950		119,020	(o)	30,364	(o)	25,600		23,950		112,701		141	
Co		32,030		32,030		35,960		130,912				26,660		33,460		125,652	(o)	24,460	(o)	24,460		31,035		136,455	(o)	26,040	(o)	26,040		31,035		137,847		142	
wer Co				16,200		27,000		129,324																										143	
Co		26,700		16,600		25,107		118,406		26,700		15,000		25,107		113,299		23,000		15,000		25,107		118,064		24,000		11,000		25,050		111,671		144	

	Co	26,700	16,200	27,000	129,324		26,700		15,000		25,107		113,299		23,000		15,000		25,107		118,064		24,000		11,000		25,050		111,671		143 144
118	Iowa Electric Light & Power Co		50,000		50,000		60,263		204,019		43,191		43,191		56,963		189,270		40,922		40,922		85,115		176,622					
119	Interstate Power Co		56,492		46,033		73,919		203,360		49,959		41,773		73,699		182,594		46,707		38,052		71,818		184,787		44,447		35,492	
120	Indiana Service Corp		47,200		28,100		31,000		198,243	(m)	42,600	(m)	22,600		31,000		165,343		46,100		24,000		31,000		201,481		41,200		27,000	
121	Mississippi Power Co		40,939		6,900		17,490		196,509	(o)	33,772	(o)	5,700		18,702		174,259	(o)	33,397	(o)	5,900		18,702		174,344	(o)	29,455	(o)	5,500	
122	Tampa Electric Co		48,800		41,400		42,500		187,584		43,800		42,500		42,500		171,654		39,400		38,400		42,500		176,837		35,000		35,000	
123	Mountain States Power Co						22,541		185,843																					
124	City of Cleveland, Dept. of Public Utilities		42,150		42,150		50,000		183,260		40,800		40,800		50,000		170,232		41,000		41,000		50,000		205,752		42,400		42,400	
125	South Carolina Power Co		35,100				42,170	(p)	181,780	(o)	31,600	(o)	26,700		41,370		160,707	(o)	29,000	(o)	29,000		41,732		163,881	(o)	30,800	(o)	25,700	
126	Turlock-Modesto Irrigation Districts		38,500		38,500		35,000		180,077		40,700		40,700		35,000		193,628	(o)	40,560	(o)	40,560		35,000		174,312		39,560		39,560	
127	Rumford Falls Power Co	(m)	29,600	(m)	29,600		28,400		172,836	(m)	30,000	(m)	30,000		28,350		182,500													
128	Jacksonville Municipal Light Plant	(m)	38,000		38,000		81,500		159,286		34,100		34,100		54,500		138,415		31,800		31,800		54,500		134,730			(m)	30,900	
129	Kansas City, Kan. Board of Public Utilities		32,600		32,600		69,000		155,988	(o)	30,500	(o)	30,500		69,000		147,814	(o)	29,400	(o)	29,400		39,000		144,708	(o)	27,500	(o)	27,500	
130	Iowa-Nebraska Light & Power Co		37,105		31,640		47,335		155,764	(o)	35,990	(o)	31,280		47,335		146,723	(o)	34,200	(o)	28,180		45,450		144,924	(o)	32,600			
131	Laclede Power & Light Co				36,400		46,500		155,085		33,400		33,400		48,500		146,657	(m)	32,200	(m)	26,000		33,500		140,282					
132	Engineer Dept., U. S. Army (Bonneville)		90,000		90,000		86,400		151,770																					
133	Southern Indiana Gas & Electric Co		34,000		34,000		62,800		149,787	(o)	33,500	(o)	33,500		67,800		130,435	(o)	35,500	(o)	35,500		50,900		143,260	(o)	34,200	(o)	34,200	
134	El Paso Electric Co		32,000		32,000		56,529		143,289		28,900		28,900		56,529		135,757		26,600		26,600		56,529		127,294		26,200		26,200	
135	Washington Gas & Electric Co		29,300		27,000		27,125		140,945		27,420				27,125		124,198		39,697		27,291		27,050		138,952		27,800		25,500	
136	Staten Island Edison Corp		36,731		37,300		46,000		140,801		33,700		33,400		47,500		127,392	(o)	31,700	(o)	31,700		47,500		130,148	(o)	31,000	(o)	30,600	
137	City of Lansing Bd. of Wtr. & Elec. Lt. Comm'rs		38,952		38,952		59,950		140,099		36,970		36,970		56,200		115,392		37,271		37,271		56,200		139,612		32,930		32,930	
138	Central Arizona Light & Power Co		34,400		34,500		28,000		135,858	(o)	33,100	(o)	32,100		28,000		133,631		31,300		19,400		15,000		125,061		23,000		19,400	
139	Luzerne County Gas & Electric Corp		26,140		44,200		55,000		133,862	(o)	25,180	(o)	41,400		55,000		130,017	(o)	26,470	(o)	44,670		55,000		139,909	(o)	27,600	(o)	40,800	
140	Central Illinois Electric & Gas Co	(k)	30,120				47,438		133,080		25,950				47,438		116,378		27,700				47,438		128,607		26,100			
141	Cambridge Electric Light Co		34,270		23,400		22,750		132,440		33,600		19,400		23,950		121,182	(o)	29,000	(o)	22,100		23,950		119,020	(o)	30,364	(o)	25,600	
142	Bangor Hydro-Electric Co		32,030		32,030		35,960		130,912				26,660		33,460		125,652	(o)	24,460	(o)	24,460		31,035		136,455	(o)	26,040	(o)	26,040	
143	The Marion-Reserve Power Co				16,200		27,000		129,324																					
144	Iowa Southern Utilities Co		26,700		16,600		25,107		118,406		26,700		15,000		25,107		113,299		23,000		15,000		25,107		118,064		24,000		11,000	
145	Merced Irrigation District		31,500		31,500	(X)	31,250		112,693		31,500		31,500	(X)	31,250		157,156		31,500		31,500	(X)	31,250		128,970					
146	Lake Superior District Power Co		23,015		22,415		30,788		112,157	(o)	19,785	(o)	18,385		30,358		103,223	(o)	19,714		18,950		30,338		102,676					
147	Panhandle Power & Light Co		18,200		18,200		30,000		107,610																					
148	Otter Tail Power Co		29,765		29,765		42,908		104,310																					
149	Lynn Gas & Electric Co		19,000		25,700		39,000		101,875																					
150	Florida Public Service Co		26,800		26,800		28,228		101,377																					
	Canada																													
151	Hydro-Electric Power Commission of Ontario	(b)	1,564,200	(b)	1,025,200		1,160,000		8,673,283		1,467,800		1,000,800		1,160,000		7,670,559		1,349,600		960,800		1,151,870		7,842,343		1,225,150		944,860	
152	Shawinigan Water & Power Co. and Subs		892,415		640,300		701,372		5,923,888		925,980		666,390		693,594		5,409,657		906,260		670,260		689,687		5,875,289		919,725		655,425	
153	Montreal Light, Heat & Power Consol. and Subs.*		587,980				568,720		3,300,437		423,890		146,500		221,500		2,078,595		432,440		155,500		231,910		2,517,938		426,950		149,000	
154	Gatineau Power Co		519,617		518,767		541,658		3,008,799	(o)	479,273	(o)	478,423		541,358		2,693,150		494,310		493,460		513,671		3,023,365		489,417		488,567	
155	Saguenay Power Co., Ltd		408,000		408,000		420,000		2,478,320		406,000		406,000		420,000		2,430,696		403,000		403,000		420,000		2,586,184		377,000		377,000	
156	Aluminum Power Co., Ltd		196,000		196,000		200,000		1,479,644		196,000		196,000		200,000		1,291,709		200,000		200,000		200,000		1,486,071		196,000		196,000	
157	West Kootenay Power & Light Co., Ltd				162,200		167,700		1,235,390		156,300		156,300		161,100		1,215,844		154,400		154,400		179,625		1,063,113				145,900	
158	Winnipeg Electric Co	(b)	172,100	(b)	172,100	(X)	263,100		830,659		174,600		174,600	(X)	263,100		769,471		159,100		159,100	(X)	263,100		867,605		159,400		159,400	
159	Canada Northern Power Corp., Ltd	(b)	104,300	(b)	70,300		94,375		749,904		99,100		67,100		94,375		700,849		91,300		64,300		94,375		649,123		83,700		64,200	
160	Canadian Niagara Power Co., Ltd				74,600		75,000		611,083				74,600		75,000		583,123			(o)	74,600		75,000		633,968				74,600	
161	City of Winnipeg Hydro-Electric System		96,700		107,044		126,820		590,672		92,600		101,810		126,820		580,275		90,000		99,899		143,190		554,813		89,000		89,350	
162	British Columbia Elec. Railway Co., Ltd. (M)		117,000		117,000	(X)	228,825		504,689	(o)	118,600	(o)	118,600	(X)	228,825		490,132	(o)	113,800	(o)	113,800		184,825		488,160	(o)	110,800	(o)	110,800	
163	Churchill River Power Co., Ltd		47,140		47,140		74,900		349,027																					
164	Great Lakes Power Co., Ltd						54,200		256,234						54,200		220,588						46,700		267,395					
165	Southern Canada Power Co., Ltd		50,400		45,000		43,865		250,875		50,600		44,800		43,865		229,254		49,200		44,600		43,865		247,781		50,800		45,400	
166	The Nova Scotia Power Comm					(Z)	76,168		244,400					(Z)	76,224		230,389					(Z)	67,362		219,096					
167	Montreal Island Power Co		29,840				45,000		238,094		29,840		29,840		45,000		227,343		33,000		33,000		45,000		245,268		33,400		33,400	
168	The Ottawa Electric Co	(b)	42,800	(b)	12,500	(X)	16,200		205,025		42,600		13,300		16,225		194,524										37,300		13,100	
169	Calgary Power Co., Ltd	(s)	34,300	(s)	37,000		66,077		145,165	(s)	53,500	(m)	37,200		67,027		133,104	(m, s)	50,600	(m)	35,000	(X)	67,027		129,839	(m)	50,154	(m)	33,500	
	Mexico																													
170	The Mexican Light and Power Co., Ltd., and Subs		209,923		206,683		238,000		1,093,569	(o)	220,628	(o)	222,761		237,000		1,177,343	(o)	217,123	(o)	215,257		237,000		1,161,262	(o)	204,029	(o)	204,029	
	Railways and Railroads																													
171	The Pennsylvania Railroad		(L)		0		0		1,148,804		(L)		81,000		88,000		977,475		(o, L)		87,150		88,000		840,212				92,000	
172	Interborough Rapid Transit Co		269,420		269,420		390,000		1,061,190		280,560		280,560		390,000		1,057,674		273,820		273,820		390,000		1,090,189		298,820		298,820	
173	Williamsburgh Power Plant Corp		164,200		164,200		220,000		657,226	(o)	160,000	(o)	160,000		220,000		589,815	(o)	161,800	(o)	161,800		204,100		605,556	(o)	164,600	(o)	164,600	
174	Chicago Surface Lines		186,176		0		0		589,565				0		0		590,420				0		0		658,057				0	
175	Board of Transportation (N. Y. City Subway)		113,269		0		0		454,048	(o)	111,351		0		0		390,968		103,840		0		0		375,135		90,657		0	
176	Philadelphia Rapid Transit Co		99,849		0		0		314,867		95,991		0		0		306,485		96,241		0		0		318,748		98,509		0	
177	The New York Central Railroad Co		67,660		0		0		243,466	(o)	74,322		0		0		236,258	(o)	71,025		0		0		240,716		65,761		67,500	
178	Boston Elevated Railway		79,100		78,000		180,000		225,622		83,630		82,530		180,000		222,153		81,505		79,905		180,000		223,998		81,795		81,795	
179	New York, New Haven & Hartford R. R. Co		40,900		23,200		43,000		171,380	(o)	41,200	(o)	19,200		43,000		160,468	(o)	46,600	(o)	25,800		43,000		180,202	(o)	45,500	(o)	23,300	
180	Norfolk & Western Railway Co		30,000		25,000		42,955		131,973		45,000		26,500		43,555		116,226		48,000		28,000		43,855		137,716		45,000		25,000	
181	Pacific Electric Railway Co		37,200		0		0		124,985		40,100		0		0		130,510		45,000		0		0		146,219		44,000		0	
182	St. Louis Public Service Co	(b)	35,600		0		0		123,507		39,100		0		0		130,263		41,000		0		0		138,923		42,640		7,800	
183	Twin City Rapid Transit Co		38,660		38,660		90,000		115,504	(o)	42,990	(o)	42,990		90,000		120,336	(o)	44,650	(o)	44,650		91,000		128,618	(o)	44,475	(o)	43,250	
184	Chicago, Milwaukee, St. Paul & Pacific R. R. Co				0		0		105,631				0		0		95,236				0		0		116,990				0	

* If an electric utility reports an annual output of 100,000,000 kw.-hr. to ELECTRICAL WORLD, it is included in this annual survey. Conversely, if it fails to meet this specification, it is automatically excluded. This accounts for the inclusion of some companies this year that were not listed in last year's survey, as well as for exclusion of other companies that may have been listed last year. In addition, however, corporate changes may effect a company's appearance or disappearance. The following changes that occurred during 1939 deserve special notice:

Memphis Power & Light and Tennessee Electric Power were sold to the Tennessee Valley Authority on May 20, 1939.

Metropolitan Edison and New Jersey Power & Light, reported separately this year, were combined in previous surveys.

Montreal Light, Heat & Power, Cons., includes Beauharnois Light, Heat & Power, previously reported separately.

South Carolina Electric & Gas and Lexington Water Power, reported separately this year, were combined in previous surveys.

(a) Company practice varies as to the period for which the peak is determined. Beginning with 1939, peak data have been requested on a 60-minute basis. (From 1931 to 1939, data were requested on a 30-minute basis.) Those peaks reported for less than 30 minutes are noted, but no distinction has been made among estimated, observed and integrated values.

(b) Fifteen-minute (20-min. for Canadian utilities).

(c) Line 40 — Peaks refer to Kansas City District only.

(d) Line 94 — Excluding purchases for surplus sales to other electric corporations but including purchases to supplement output of generating stations for use of customers in Central Hudson territory.

(e) Line 24 — Over one-hour period. Excludes all energy supplied to Potomac Electric Power Co. and The Pennsylvania Railroad Co. (1939).

(f) Line 69 — Columbus district only; one hour.

(g) Line 24 — Includes "firm peak service" to Potomac Electric Power Co.; in 1937, 15,783,000 kw.-hr.; 1938, 13,821,000.

(h) Line 76 — Sum of peaks of two divisions. 1939 — Bridgeport, 54,300, New Haven, 46,800; 1938 — 48,500 and 46,400; 1937 — 44,700 and 42,200; 1936 — 44,500 and 43,100. (77) Peaks are for company and affiliates, combined capacity, 145,161 kw.

(j) Line 21 — Instantaneous, includes station use.

(k) Thirty-minute.

(l) Not available, due to large number of plants, many of which are not inter-connected.

(m) Instantaneous or five-minute.

(o) Over one-hour period.

(p) Lines 26, 85, 95, 125 — See Table II.

(r) Line 66 — Gross peak.

(s) Line 28 — In 1938, sum of peaks of five systems, one of which greatly predominates. In earlier years, peak of interconnected system only. (91) Thirty-minute peaks on interconnected system. (169) Instantaneous peaks on interconnected system.

(t) Line 34 — Includes net interchange received. Compares with instantaneous peaks of 193,000 in 1937, 203,000 in 1938.

(u) Line 34 — Includes net interchange delivered.

(v) Line 33 — Incl. Chelan Elec. Co. in 1938 and seven months in 1937. For earlier years Chelan see supplement May 8, 1937.

(x) Line 114 — Fiscal year ended June 30, 1937.

(y) Line 50 — 164,696. (8 boiler capac

(C) Line 1 — C Canada) inc system.

(D) Includes af Note (D), T

(L) Line 171 — In 1938, LI LIRR 84,48

(M) Line 162 —

(X) Kva.

(Z) Hp.

nt Co.*		85,000		55,000		55,270		204,602																							
wer Co		50,000		50,000		60,263		204,019		43,191		43,191		56,963		89,270		40,922		40,922		65,115		178,822		50,402		35,492		69,497		173,233	119
		56,492		46,033		73,919		203,360		49,959		41,773		73,699		182,594		46,707		38,052		71,818		184,787		44,447		35,492		69,497		173,233	119
		47,200		28,100		31,000		198,243	(m)	42,600	(m)	22,600		31,000		165,343		46,100		24,000		31,000		201,481		41,200		27,000		31,000		184,776	120
		40,939		6,900		17,490		196,509	(o)	33,772	(o)	5,700		18,702		174,259	(o)	33,397	(o)	5,900		18,702		174,344	(o)	29,455	(o)	5,500		18,453		146,009	121
		48,800		41,400		42,500		187,584		43,800		42,500		42,500		171,654		39,400		38,400		42,500		176,837		35,000		35,000		35,000		163,243	122
Co						22,541		185,843																									123
of Public Utilities		42,150		42,150		50,000		183,260		40,800		40,800		50,000		170,232		41,000		41,000		50,000		205,752		42,400		42,400		50,000		184,834	124
		35,100				42,170	(p)	181,780	(o)	31,600	(o)	26,700		41,370		160,707	(o)	29,000	(o)	29,000		41,732		163,881	(o)	30,800	(o)	25,700		36,332		138,394	125
on Districts		38,500		38,500		35,000		180,077		40,700		40,700		35,000		193,628	(o)	40,560	(o)	40,560		35,000		174,312		39,560		39,560		35,000		158,258	126
	(m)	29,600	(m)	29,600		28,400		172,836	(m)	30,000	(m)	30,000		28,350		182,500																	127
ght Plant	(m)	38,000		38,000		81,500		159,286		34,100		34,100		54,500		138,415		31,800		31,800		54,500		134,730			(m)	30,900		54,500		117,319	128
of Public Utilities		32,600		32,600		69,000		155,988	(o)	30,500	(o)	30,500		69,000		147,814	(o)	29,400	(o)	29,400		39,000		144,708	(o)	27,500	(o)	27,500		39,000		135,366	129
Power Co		37,105		31,640		47,335		155,764	(o)	35,990	(o)	31,280		47,335		146,723	(o)	34,200	(o)	28,180		45,450		144,924	(o)	32,600				43,503		141,706	130
o				36,400		46,500		155,085		33,400		33,400		48,500		146,657	(m)	32,200	(m)	26,000		33,500		140,282									131
my (Bonneville)		90,000		90,000		86,400		151,770																									132
Electric Co		34,000		34,000		62,800		149,787	(o)	33,500	(o)	33,500		67,800		130,435	(o)	35,500	(o)	35,500		50,900		143,260	(o)	34,200	(o)	34,200		50,900		128,476	133
		32,000		32,000		56,529		143,289		28,900		28,900		56,529		135,757		26,600		26,600		56,529		127,294		26,200		26,200		56,529		117,178	134
ic Co		29,300		27,000		27,125		140,945		27,420				27,125		124,198		39,697		27,291		27,050		138,952		27,800		25,500		24,000		135,884	135
p		36,731		37,300		46,000		140,801		33,700		33,400		47,500		127,392	(o)	31,700	(o)	31,700		47,500		130,148	(o)	31,000	(o)	30,600		47,500		122,722	136
tr. & Elec. Lt. Comm'rs		38,952		38,952		59,950		140,099		36,970		36,970		56,200		115,392		37,271		37,271		56,200		139,612		32,930		32,930		66,700		121,838	137
Power Co		34,400		34,500		28,000		135,858	(o)	33,100	(o)	32,100		28,000		133,631		31,300		19,400		15,000		125,061		23,000		19,400		15,500		106,533	138
Electric Corp		26,140		44,200		55,000		133,862	(o)	25,180	(o)	41,400		55,000		130,017	(o)	26,470	(o)	44,670		55,000		139,909	(o)	27,600	(o)	40,800		55,000		142,525	139
& Gas Co	(k)	30,120				47,438		133,080		25,950				47,438		116,378		27,700				47,438		128,607		26,100				44,938		117,906	140
Co		34,270		23,400		22,750		132,440		33,600		19,400		23,950		121,182	(o)	29,000	(o)	22,100		23,950		119,020	(o)	30,364	(o)	25,600		23,950		112,701	141
o		32,030		32,030		35,960		130,912				26,660		33,460		125,652	(o)	24,460	(o)	24,460		31,035		136,455	(o)	26,040	(o)	26,040		31,035		137,847	142
er Co				16,200		27,000		129,324																									143
Co		26,700		16,600		25,107		118,406		26,700		15,000		25,107		113,299		23,000		15,000		25,107		118,064		24,000		11,000		25,050		111,671	144
t		31,500		31,500	(X)	31,250		112,693		31,500		31,500	(X)	31,250		157,156		31,500		31,500	(X)	31,250		128,970									145
ower Co		23,015		22,415		30,788		112,157	(o)	19,785	(o)	18,385		30,358		103,223	(o)	19,714		18,950		30,338		102.676									146
t Co		18,200		18,200		30,000		107,610																									147
		29,765		29,765		42,908		104,310																									148
		19,000		25,700		39,000		101,875																									149
		26,800		26,800		28,228		101,377																									150
Canada																																	
mmission of Ontario	(b)	1,564,200	(b)	1,025,200		1,160,000		8,673,283		1,467,800		1,000,800		1,160,000		7,670,559		1,349,600		960,800		1,151,870		7,842,343		1,225,150		944,860		1,139,400		7,068,215	151
er Co. and Subs		892,415		640,300		701,372		5,923,888		925,980		666,390		693,594		5,409,657		906,260		670,260		689,687		5,875,289		919,725		655,425		619,150		5,815,484	152
Power Consol. and Subs.*		587,980				568,720		3,300,437		423,890		146,500		221,500		2,078,595		432,440		155,500		231,910		2,517,938		426,950		149,000		231,910		2,210,976	153
		519,617		518,767		541,658		3,008,799	(o)	479,273	(o)	478,423		541,358		2,693,150		494,310		493,460		513,671		3,023,365		489,417		488,567		492,995		2,761,655	154
		408,000		408,000		420,000		2,478,320		406,000		406,000		420,000		2,430,696		403,000		403,000		420,000		2,586,184		377,000		377,000		330,000		2,466,666	155
td		196,000		196,000		200,000		1,479,644		196,000		196,000		200,000		1,291,709		200,000		200,000		200,000		1,486,071		196,000		196,000		200,000		1,180,326	156
Light Co., Ltd				162,200		167,700		1,235,390		156,300		156,300		161,100		1,215,844		154,400		154,400		179,625		1,063,113				145,900		169,825		1,001,360	157
	(b)	172,100	(b)	172,100	(X)	263,100		830,659		174,600		174,600	(X)	263,100		769,471		159,100		159,100	(X)	263,100		867,605		159,400		159,400	(X)	263,000		824,997	158
Corp., Ltd	(b)	104,300	(b)	70,300		94,375		749,904		99,100		67,100		94,375		700,849		91,300		64,300		94,375		649,123		83,700		64,200		94,375		594,753	159
Co., Ltd				74,600		75,000		611,083				74,600		75,000		583,123			(o)	74,600		75,000		633,968				74,600		75,000		576,073	160
-Electric System		96,700		107,044		126,820		590,672		92,600		101,810		126,820		580,275		90,000		99,899		143,190		554,813		89,000		89,350		107,424		555,962	161
Railway Co., Ltd. (M)		117,000		117,000	(X)	228,825		504,689	(o)	118,600	(o)	118,600	(X)	228,825		490,132	(o)	113,800	(o)	113,800		184,825		488,160	(o)	110,800	(o)	110,800		184,825		465,980	162
o., Ltd		47,140		47,140		74,900		349,027																									163
Ltd						54,200		256,234						54,200		220,588						46,700		267,395						39,200		250,454	164
Co., Ltd		50,400		45,000		43,865		250,875		50,600		44,800		43,865		229,254		49,200		44,600		43,865		247,781		50,800		45,400		43,865		223,998	165
Comm					(Z)	76,168		244,400					(Z)	76,224		230,389					(Z)	67,362		219,096					(Z)	67,280		223,086	166
Co		29,840				45,000		238,094		29,840		29,840		45,000		227,343		33,000		33,000		45,000		245,268		33,400		33,400		45,000		214,168	167
	(b)	42,800	(b)	12,500	(X)	16,200		205,025		42,600		13,300		16,225		194,524										37,300		13,100		16,000		182,920	168
	(s)	34,300	(s)	37,000		66,077		145,165	(s)	53,500	(m)	37,200		67,027		133,104	(m, s)	50,600	(m)	35,000	(X)	67,027		129,839	(m)	50,154	(m)	33,500		67,090		124,860	169
Mexico																																	
Power Co., Ltd., and Subs		209,923		206,683		238,000		1,093,569	(o)	220,628	(o)	222,761		237,000		1,177,343	(o)	217,123	(o)	215,257		237,000		1,161,262	(o)	204,029	(o)	204,029		211,300		1,029,399	170
and Railroads																																	
oad	(L)			0		0		1,148,804	(L)			81,000		88,000		977,475	(o, L)			87,150		88,000		840,212				92,000		88,000		812,766	171
nsit Co		269,420		269,420		390,000		1,061,190		280,560		280,560		390,000		1,057,674		273,820		273,820		390,000		1,090,189		298,820		298,820		390,000		1,136,728	172
ant Corp		164,200		164,200		220,000		657,226	(o)	160,000	(o)	160,000		220,000		589,815	(o)	161,800	(o)	161,800		204,100		605,556	(o)	164,600	(o)	164,600		204,100		612,754	173
		186,176		0		0		589,565				0		0		590,420				0		0		658,057				0		0		645,076	174
(N. Y. City Subway)		113,269		0		0		454,048	(o)	111,351		0		0		390,968		103,840		0		0		375,135		90,657		0		0		290,594	175
nsit Co		99,849		0		0		314,867		95,991		0		0		306,485		96,241		0		0		318,748		98,509		0		0		319,645	176
Railroad Co		67,660		0		0		243,466	(o)	74,322		0		0		236,258	(o)	71,025		0		0		240,716		65,761		67,500		0		236,664	177
y		79,100		78,000		180,000		225,622		83,630		82,530		180,000		222,153		81,505		79,905		180,000		223,998		81,795		81,795		180,000		226,310	178
& Hartford R. R. Co		40,900		23,200		43,000		171,380	(o)	41,200	(o)	19,200		43,000		160,468	(o)	46,600	(o)	25,800		43,000		180,202	(o)	45,500	(o)	23,300		43,000		175,794	179
way Co		30,000		25,000		42,955		131,973		45,000		26,500		43,555		116,226		48,000		28,000		43,855		137,716		45,000		25,000		43,855		133,046	180
Co		37,200		0		0		124,985		40,100		0		0		130,510		45,000		0		0		146,219		44,000		0		0		143,450	181
Co	(b)	35,600		0		0		123,507		39,100		0		0		130,263		41,000		0		0		138,923		42,640		7,800		12,000		141,609	182
t Co		38,660		38,660		90,000		115,504	(o)	42,990	(o)	42,990		90,000		120,336	(o)	44,650	(o)	44,650		91,000		128,618	(o)	44,475	(o)	43,250		91,000		131,393	183
Paul & Pacific R. R. Co				0		0		105,631				0		0		95,236				0		0		116,990				0		0		113,501	184

reports an annual output of ELECTRICAL WORLD, it is included onversely, if it fails to meet this tically excluded. This accounts companies this year that were rvey, as well as for exclusion of have been listed last year. In rate changes may effect a com- disappearance. The following ring 1939 deserve special notice: ght and Tennessee Electric e Tennessee Valley Author-

and New Jersey Power &

Light, reported separately this year, were combined in previous surveys.
Montreal Light, Heat & Power, Cons., includes Beauharnois Light, Heat & Power, previously reported separately.
South Carolina Electric & Gas and Lexington Water Power, reported separately this year, were combined in previous surveys.

(a) Company practice varies as to the period for which the peak is determined. Beginning with 1939, peak data have been requested on a 60-minute basis. (From 1931 to 1939, data were requested on a 30-minute basis.) Those peaks reported for less than 30 minutes are noted, but no distinction has been made among estimated, observed and integrated values.

(b) Fifteen-minute (20-min. for Canadian utilities).
(c) Line 40 — Peaks refer to Kansas City District only.
(d) Line 94 — Excluding purchases for surplus sales to other electric corporations but including purchases to supplement output of generating stations for use of customers in Central Hudson territory.
(e) Line 24 — Over one-hour period. Excludes all energy supplied to Potomac Electric Power Co. and The Pennsylvania Railroad Co. (1939).
(f) Line 69 — Columbus district only; one hour.
(g) Line 24 — Includes "firm peak service" to Potomac Electric Power Co.; in 1937, 15,783,000 kw.-hr.; 1938, 13,821,000.

(h) Line 76 — Sum of peaks of two divisions. 1939 — Bridgeport, 54,300, New Haven, 46,800; 1938 — 48,500 and 46,400; 1937 — 44,700 and 42,200; 1936 — 44,500 and 43,100. (77) Peaks are for company and affiliates, combined capacity, 145,161 kw.
(j) Line 21 — Instantaneous, includes station use.
(k) Thirty-minute.
(l) Not available, due to large number of plants, many of which are not inter-connected.
(m) Instantaneous or five-minute.
(o) Over one-hour period.
(p) Lines 26, 85, 95, 125 — See Table II.
(r) Line 66 — Gross peak.

(s) Line 28 — In 1938, sum of peaks of five systems, one of which greatly predominates. In earlier years, peak of interconnected system only. (91) Thirty-minute peaks on interconnected system. (169) Instantaneous peaks on interconnected system.
(t) Line 34 — Includes net interchange received. Compares with instantaneous peaks of 193,000 in 1937, 203,000 in 1938.
(u) Line 34 — Includes net interchange delivered.
(v) Line 33 — Incl. Chelan Elec. Co. in 1938 and seven months in 1937. For earlier years Chelan see supplement May 8, 1937.
(x) Line 114 — Fiscal year ended June 30, 1937.

(y) Line 50 — Name plate rating, capable capacity, 164,696. (87) 72,500-kw. generator limited by boiler capacity to 66,000.
(C) Line 1 — Canadian Niagara Power Co., Ltd., (see Canada) included in Niagara Hudson Power Corp. system.
(D) Includes affiliated or subsidiary companies. See Note (D), Table II.
(L) Line 171 — In 1939, LIRR 75,757; PRR 185,280. In 1938, LIRR 73,200; PRR (o) 189,786. In 1937, LIRR 84,482; PRR 169,825. Not coincident.
(M) Line 162 — Mainland system only.
(X) Kva.
(Z) Hp.

Supplement to ELECTRICAL WORLD, May 4, 1940
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For explanation and comments relating to these statistics, the "Electrical World" of May 4, 1940, should be consulted.

Table II—Detailed Data on Generator Rating, Output, Customers and Distribution of Energy of Public Utility Systems Having an Output Exceeding 100,000,000 Kw.-Hr. During 1939

This tabu... erating con... statistics a... for proper... corporate ... single phy...

Line No.	Section and System	Generator Rating, Dec. 31, 1939: Fuel Burning No. of Plants	Fuel Burning Rating of Generators Kw.	Hydro No. of Plants	Hydro Rating of Generators Kw.	Source of Energy, 1939, Thous. Kw.-Hr.: Generated Net	Received by Purchase or Interchange, Net	Total Input Net	Disposal of Energy in Thousands Kw.-Hr.: Used by Electric Railway Dept.	Used by Electric and Other Depts.	Lost and Unaccounted For	To Other Public Utilities	Sales to Ultimate Consumers
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
	New England States												
1	New England Power Association (Consolidated)	u 17	396,430	u 25	314,584	1,916,189	574,747	2,490,936	27,104	57,878	324,412	603,313	1,478,229
2	Boston Edison Company	2	388,860	2	300	1,303,185	150,180	1,453,365	0	13,712	186,268	351,567	901,818
3	The Connecticut Light and Power Co	2	130,000	9	64,625	625,919	154,189	780,108	0	7,378	105,388	121,013	546,329
4	The Hartford Electric Light Co	2	164,000	1	1,500	559,362	12,087	571,449	0	1,897	27,300	268,805	273,447
5	Central Maine Power Co	5	18,747	24	114,350	537,245	27,867	565,112	H 4,719	32,815	72,575	46,509	408,494
6	Western Massachusetts Companies	3	61,000	7	99,050	327,282	157,354	484,636	0	6,448	72,694	80,113	325,381
7	Montaup Electric Co	1	75,000	0	0	460,346	6,483	466,829	0	0	0	466,829	0
8	The United Illuminating Co	2	160,000	0	0	409,369	0	409,369	0	2,590	44,799	13,776	348,204
9	Public Service Co. of New Hampshire	5	63,450	31	62,994	301,052	12,540	313,592	3,731	5,548	41,873	84,221	178,219
10	The Connecticut Power Co	1	38,740	2	10,600	165,521	147,243	312,764	0	3,415	34,090	130,338	144,921
11	New Bedford Gas and Edison Light Co	1	92,000	0	0	237,308	0	237,308	0	2,249	20,649	42,664	171,746
12	Blackstone Valley Gas & Electric Co	1	33,500	4	1,850	25,231	207,111	232,342	0	1,905	27,568	5,858	197,011
13	Cumberland County Power and Light Co	2	36,000	11	30,075	170,775	39,281	210,056	9,939	4,410	27,495	12,910	155,302
14	Rumford Falls Power Co	0	0	2	28,400	172,836	0	172,836	0	0	3,671	5,997	163,168
15	Cambridge Electric Light Co	1	22,750	0	0	97,628	34,812	132,440	0	1,152	5,181	12,635	113,472
16	Bangor Hydro-Electric Co	0	0	12	35,960	130,898	14	130,912	2,558	1,088	22,843	12,958	91,465
17	Lynn Gas and Electric Co	1	39,000	0	0	99,672	2,203	101,875	0	2,334	6,284	32,971	60,286
	Totals for section	46	1,719,477	130	764,288	7,539,818	1,526,111	9,065,929	48,051	144,819	1,023,090	2,292,477	5,557,492
	Middle Atlantic States												
18	Niagara Hudson System (e)	6	596,850	90	979,788	6,171,113	1,447,480	7,618,593	2,535	79,783	892,669	1,189,926	5,453,680
19	Consolidated Edison Co. of New York, Inc. (D)	10	2,566,300	0	0	7,135,709	241,145	7,376,854	0	68,375	898,684	7	6,409,788
20	Philadelphia Electric Co. System	8	872,360	3	253,765	4,345,918	—92,497	4,253,421	0	k 13,464	421,079	221,741	3,597,137
21	Public Service Electric and Gas Co	5	737,700	0	0	2,875,802	119,145	2,994,947	k 96,344	27,054	388,022	3,364	2,480,163
22	American Water Works and Electric Co., Inc	28	570,410	u 11	57,390	2,412,663	57,900	2,470,563	32,082	15,378	313,046	22,798	2,087,259
23	Duquesne Light Co	u 4	504,000	0	0	2,003,631	4,149	2,007,780	0	5,811	174,615	233	1,827,121
24	Pennsylvania Power & Light Co	16	346,812	20	44,877	1,613,966	260,629	1,874,595	0	k 4,097	231,472	13,462	1,625,564
25	Penn. W. & P. Co.,— Safe Harbor W. P. Corp	1	20,000	2	291,000	1,300,977	b 18,218	1,319,195	0	0	52,178	1,107,761	159,256
26	New York State Electric & Gas Corp (D)	10	101,403	15	22,880	485,312	453,990	939,302	778	5,458	129,856	136,139	667,071
27	Metropolitan Edison Co	3	169,000	4	21,928	499,504	233,993	733,497	0	9,659	87,549	94,868	541,421
28	Rochester Gas and Electric Corp	6	114,975	10	48,375	439,915	32,178	472,093	0	18,547	63,961	2,780	386,805
29	Pennsylvania Electric Co	4	57,100	0	0	326,327	71,344	397,671	0	4,609	80,101	32,096	280,865
30	Long Island Lighting System	6	239,100	0	0	389,086	17	389,103	0	8,699	64,445	12,307	303,652
31	Jersey Central Power & Light Co	5	137,300	1	350	385,110	—34,960	350,150	0	6,619	54,788	7,085	281,658
32	Atlantic City Electric Co	2	m 120,000	0	0	347,090	37	347,127	0	3,986	42,963	3,980	296,198
33	Pennsylvania Edison Co	3	76,100	2	4,100	287,389	b 24,214	311,603	0	1,416	41,355	45,411	223,421
34	Central Hudson Gas & Elec. Corp	1	12,000	5	23,480	74,763	231,669	306,432	0	7,962	37,263	56,077	205,130
35	The Scranton Electric Co	3	m 117,700	0	0	303,703	2,116	305,819	0	1,947	25,729	14,939	263,204
36	Pennsylvania Power Co	2	37,500	0	0	85,036	169,981	255,017	0	82	22,861	7,699	224,375
37	New Jersey Power & Light Co	1	55,000	1	270	339,523	—134,921	204,602	0	1,564	27,774	8,110	167,154
38	Staten Island Edison Corp	1	46,000	0	0	130,034	10,767	140,801	0	2,367	16,756	1,840	119,838
39	Luzerne County Gas and Electric Corp	2	55,000	0	0	207,848	—73,986	133,862	0	1,604	12,154	1,142	118,962
	Totals for section	127	7,552,610	164	1,748,203	32,160,419	3,042,608	35,203,027	131,739	288,481	4,079,320	2,983,765	27,719,722
	East North Central States												
40	Commonwealth Edison Co. and Subs (D)	14	1,998,000	6	7,765	7,550,378	11,240	7,561,618	0	(v)	v 876,811	1,045,839	5,638,968
41	American Gas & Electric Co. (Central System)	22	m 938,488	18	190,338	4,785,726	—26,195	4,759,531	0	28,844	521,478	590,101	3,619,108
42	The Detroit Edison Co	7	1,011,375	7	9,300	3,121,235	6,734	3,127,969	0	32,509	334,996	108,263	2,652,201
43	The Cleveland Electric Illuminating Co. (A)	4	523,750	0	0	1,808,565	11,581	1,820,146	0	8,302	212,492	15,944	1,583,408
44	Consumers Power Co	8	325,900	43	147,815	1,591,549	141,571	1,733,120	0	2,390	288,471	28,488	1,413,771
45	Columbia Gas & Electric Corp. and Subs. (D)	5	511,750	0	0	1,605,971	—33,662	1,572,309	11,638	21,599	164,919	114,098	1,260,055
46	Wisconsin Electric Pwr. Co. and Affil. Cos. (D)	u 8	n 508,610	u 13	36,870	1,504,875	45,377	1,550,252	2,250	17,445	220,636	48,185	1,261,736
47	Ohio Edison Co	5	331,500	1	1,950	1,137,032	52,100	1,189,132	0	4,640	121,422	241,922	821,148
48	Public Service Co. of Indiana	6	129,230	2	4,290	713,968	145,738	859,706	0	5,658	121,536	293,254	439,258
49	Northern Indiana Public Service Co	3	96,100	9	19,355	309,601	489,715	799,316	0	11,970	86,164	125,605	575,577
50	The Ohio Public Service Co	8	129,100	0	0	555,515	100,173	655,688	767	3,064	70,749	72,674	508,434
51	The Toledo Edison Co	4	175,280	1	5,000	479,939	73,240	553,179	0	3,756	67,956	12,567	468,900
52	Indianapolis Power & Light Co	4	184,000	0	0	521,827	500	522,327	0	6,791	50,788	2,238	462,510
53	Central Illinois Public Service Co	2	75,000	0	0	240,317	250,858	491,175	0	20,944	82,681	49,861	337,689
54	Columbus and Southern Ohio Elec. Co	16	183,350	0	0	447,522	8,839	456,361	22,610	4,073	66,196	21,080	342,402
55	Wisconsin Public Service Corp. and Sub. (D)	4	41,250	20	65,436	384,035	5,633	389,668	1,992	3,250	63,456	56,467	264,503
56	Central Illinois Light Co	4	113,500	0	0	385,670	3,201	388,871	0	1,899	34,324	2,727	349,921
57	Wisconsin Power & Light Co	6	50,604	30	39,591	325,085	22,761	347,846	344	6,358	60,621	91,635	188,888
58	Northern Indiana Power Co	2	17,000	1	384	898	271,129	272,027	0	1,107	50,002	32,619	188,299
59	City of Detroit Public Lighting Commission	1	80,000	0	0	206,422	6,220	212,642	0	115,400	13,176	0	84,066
60	The Sanitary District of Chicago	0	0	1	35,000	70,920	140,446	211,366	0	819	4,673	0	205,874
61	Indiana Service Corp	1	31,000	0	0	58,648	139,595	198,243	11,747	558	14,947	20,585	150,406
62	City of Cleveland, Dept. of Public Utilities	1	50,000	0	0	183,260	0	183,260	0	0	20,533	2,135	160,592

Line No.	Section and System	Distribution of Sales to Ultimate Consumers in Thousands of Kilowatt-Hrs.: Farm, or Farm and Rural	Domestic Service	Commercial: Small Light and Power (Retail)	Commercial: Large Light and Power (Wholesale)	Municipal Street Light and Other Public	Railways and Electrified Railroads	Other Sales to Ultimate Consumers	Number of Customers, Dec. 31, 1939: Farm or Rural	Domestic	Commercial Small Light and Power	Commercial Large Light and Power	Other Ultimate Consumers	Total
(1)	(2)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)
	New England States													
1	New England Power Association (Consolidated)	3,103	283,994	(c)	c 1,134,757	42,120	14,255	0	1,218	454,701	(c)	c 71,650	215	527,784
2	Boston Edison Company	5,342	246,201	201,524	401,792	32,038	14,921	0	a 2,306	a 339,604	a 71,576	a 850	a 118	a 414,454
3	The Connecticut Light and Power Co	(f)	154,267	57,880	304,584	11,087	18,511	0	(f)	148,268	18,152	1,905	0	168,325
4	The Hartford Electric Light Co	(f)	81,942	77,482	91,992	8,433	13,598	0	(f)	63,452	10,113	210	25	73,800
5	Central Maine Power Co	8,912	46,918	29,525	307,540	4,748	3,185	7,666	10,956	64,410	10,885	1,981	1,487	89,719
6	Western Massachusetts Companies	(f)	f 69,305	51,772	182,456	8,697	11,434	1,717	(f)	f 80,037	13,293	1,910	44	95,284
7	Montaup Electric Co	0	0	0	0	0	0	0	0	0	0	0	0	0
8	The United Illuminating Co	(f)	f 83,148	73,549	183,531	7,976	0	0	(f)	f 116,224	15,916	3,466	15	135,621
9	Public Service Co. of New Hampshire	8,217	37,523	22,319	101,059	5,134	19	l 3,948	8,974	52,768	8,636	1,073	981	72,432
10	The Connecticut Power Co	(f)	55,469	23,519	61,697	3,961	0	275	(f) (a)	a 49,229	a 7,467	a 1,673	a 1	a 58,370
11	New Bedford Gas and Edison Light Co	847	18,498	11,876	136,485	2,820	0	1,220	480	37,942	4,513	722	272	43,929
12	Blackstone Valley Gas & Electric Co	(f)	f 24,220	17,723	148,135	3,057	0	3,876	(f)	f 45,661	5,566	501	223	51,951
13	Cumberland County Power and Light Co	2,099	33,058	46,147	68,411	3,879	409	1,299	2,062	44,936	8,986	12	472	56,468
14	Rumford Falls Power Co	0	0	0	163,168	0	0	0	0	0	0	1	0	1
15	Cambridge Electric Light Co	.....	19,026	23,305	65,802	3,840	0	1,499	.....	29,732	5,221	152	138	35,243
16	Bangor Hydro-Electric Co	(f)	f 19,781	13,670	55,781	1,802	.....	431	(f)	f 25,566	5,177	942	75	31,760
17	Lynn Gas and Electric Co	.....	19,799	9,015	24,339	5,349	1,624	160	.....	34,290	5,257	510	47	40,104
	Totals for section	28,520	1,193,149	659,306	3,431,529	144,941	77,956	22,091	25,996	1,586,820	190,758	87,558	4,113	1,895,245
	Middle Atlantic States													
18	Niagara Hudson System (e)	53,443	558,614	712,552	3,946,884	83,514	64,086	34,587	44,056	590,415	88,007	2,432	829	725,739
19	Consolidated Edison Co. of New York, Inc. (D)	0	1,242,588	1,552,591	1,967,551	164,637	1,202,861	279,560	0	a 1,974,264	a 407,473	a 24,296	a 3,459	a 2,409,492
20	Philadelphia Electric Co. System	w 15,914	577,394	460,388	1,561,791	30,931	923,157	27,562	w 9,791	595,853	121,395	1,718	535	729,292
21	Public Service Electric and Gas Co	(f)	f 564,388	f 631,148	1,184,600	66,688	33,339	0	(f)	f 799,264	f 159,928	1,086	225	960,503
22	American Water Works and Electric Co., Inc	(f)	f 299,229	209,969	1,538,225	22,880	16,956	[0	(f)	f 353,308	48,811	3,693	431	406,243
23	Duquesne Light Co	.....	296,827	148,476	1,160,557	27,841	193,420	0	.....	310,044	33,513	3,046	111	346,714
24	Pennsylvania Power & Light Co	31,306	222,962	181,900	1,088,790	21,834	31,710	47,062	25,519	321,467	51,822	3,489	3,054	405,351
25	Penn. W. & P. Co.,— Safe Harbor W. P. Corp	0	0	0	0	0	159,256	0	0	0	0	0	1	1
26	New York State Electric & Gas Corp (D)	33,011	169,856	123,429	283,695	23,819	461	32,800	29,277	200,466	29,645	1,947	4,170	265,505
27	Metropolitan Edison Co	11,431	74,790	48,096	381,088	6,437	11,407	8,172	9,477	95,074	14,532	2,362	953	122,398
28	Rochester Gas and Electric Corp	8,729	83,433	111,913	129,814	21,037	17,084	l 14,795	9,021	111,897	13,806	825	1,109	136,658
29	Pennsylvania Electric Co	5,811	57,668	46,791	158,329	3,943	1,800	6,523	6,723	85,358	12,113	1,359	954	106,507
30	Long Island Lighting System	.....	129,044	68,082	62,575	24,649	14,136	5,166	.....	149,595	19,689	4,102	249	173,635
31	Jersey Central Power & Light Co	w 1,933	75,081	42,380	138,224	9,190	12,028	2,822	w 447	92,781	13,823	883	150	108,084
32	Atlantic City Electric Co	8,569	62,743	57,440	133,336	10,279	9,135	k 14,696	a 6,020	a 74,821	a 14,304	a 89	a 1,230	a 96,464
33	Pennsylvania Edison Co	6,592	35,568	18,187	148,791	2,746	7,865	3,672	7,983	48,684	6,215	1,941	607	65,430
34	Central Hudson Gas & Elec. Corp	13,206	51,625	41,152	91,723	7,424	0	0	6,536	59,443	11,746	136	81	77,942
35	The Scranton Electric Co	810	49,746	33,189	160,754	4,652	11,063	k 2,990	917	72,448	9,432	262	444	83,503
36	Pennsylvania Power Co	.....	42,800	30,349	146,088	3,023	2,115	0	.....	44,832	5,629	65	33	50,559
37	New Jersey Power & Light Co	8,957	33,907	19,948	92,732	3,623	7,976	11	3,744	43,078	6,215	662	165	53,864
38	Staten Island Edison Corp	132	33,623	18,054	35,695	7,073	16,294	8,967	102	41,238	6,240	131	491	48,202
39	Luzerne County Gas and Electric Corp	918	18,440	13,200	76,809	2,456	6,869	270	1,636	32,454	3,476	118	36	37,720
	Totals for section	200,762	4,680,326	4,569,234	14,488,051	548,676	2,743,018	489,655	161,249	6,096,784	1,077,814	54,642	19,317	7,409,806
	East North Central States													
40	Commonwealth Edison Co. and Subs (D)	40,755	1,046,841	760,385	2,673,023	226,267	891,697	0	29,212	1,178,480	154,992	4,933	535	1,368,152
41	American Gas & Electric Co. (Central System)	52,017	439,770	312,206	2,697,312	29,617	14,569	k 73,617	a 51,178	a 510,499	a 79,437	a 2,131	a 6,431	a 649,676
42	The Detroit Edison Co	31,205	j 565,394	597,359	1,359,623	24,546	39,141	34,933	31,225	562,844	78,777	491	480	673,817
43	The Cleveland Electric Illuminating Co. (A)	10,360	255,679	o 216,255	o 926,172	17,200	149,199	8,543	7,700	279,373	42,277	789	496	330,635
44	Consumers Power Co	.....	433,375	285,505	657,881	21,886	3,873	s 11,251	.....	383,915	61,065	658	393	446,031
45	Columbia Gas & Electric Corp. and Subs. (D)	(f)	f 289,823	187,028	602,399	93,017	87,788	0	(f)	f 317,682	41,463	5,883	2,292	367,320
46	Wisconsin Electric Pwr. Co. and Affil. Cos. (D)	31,976	290,118	187,118	593,009	37,835	99,573	22,107	23,399	284,779	42,776	619	1,211	352,784
47	Ohio Edison Co	.....	207,010	165,111	415,380	14,754	17,799	s 1,094	.....	178,958	19,863	279	79	199,179
48	Public Service Co. of Indiana	5,972	78,442	66,283	200,045	10,154	64,640	k 13,722	7,044	115,534	21,660	2,453	1,915	148,606
49	Northern Indiana Public Service Co	11,811	53,534	34,550	427,240	6,712	29,055	k 12,675	7,630	73,094	11,691	1,905	1,109	95,429
50	The Ohio Public Service Co	14,660	69,747	57,581	358,973	7,473	0	0	14,672	77,221	12,147	344	38	104,422
51	The Toledo Edison Co	10,151	84,949	86,013	266,435	11,357	9,995	0	11,317	93,506	14,560	258	52	119,693
52	Indianapolis Power & Light Co	.....	104,898	97,760	239,592	18,572	0	1,688	.....	111,297	13,852	305	11	125,465
53	Central Illinois Public Service Co	9,202	79,812	55,909	172,808	9,772	0	10,186	7,350	128,718	26,509	4,608	503	167,688
54	Columbus and Southern Ohio Elec. Co	7,510	90,869	88,967	139,764	2,975	0	12,317	12,355	117,094	17,139	978	1,068	148,634
55	Wisconsin Public Service Corp. and Sub. (D)	16,372	49,815	45,315	143,874	6,521	0	2,606	14,745	62,284	12,594	419	176	90,218
56	Central Illinois Light Co	.....	65,457	60,418	218,946	4,926	0	s 174	.....	62,100	9,223	196	34	71,553
57	Wisconsin Power & Light Co	17,464	60,627	59,543	43,425	7,093	0	736	16,954	78,989	17,230	99	242	113,514
58	Northern Indiana Power Co	6,439	27,317	22,103	123,843	3,203	0	5,394	6,169	44,602	8,572	1,067	831	61,241
59	City of Detroit Public Lighting Commission	0	0	260	13,027	0	70,779	0	0	0	15	15	1	31
60	The Sanitary District of Chicago	0	0	0	1,013	122,552	0	o 82,309	0	0	0	9	5	14
61	Indiana Service Corp	2,536	17,550	18,878	105,315	615	3,006	2,506	2,955	18,224	3,001	871	234	25,285
62	City of Cleveland, Dept. of Public Utilities	.....	37,979	37,757	54,286	30,570	0	0	.....	45,641	8,584	192	1	54,418

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Table II—Detailed Data on Generator Rating, Output, Customers and Distribution of Energy of Public Utility Systems Having an Output Exceeding 100,000,000 Kw.-Hr. During 1939

This tabulation is based on the operating company as the unit. Group statistics are given in a few instances for properties which, though distinct corporate entities, are operated as a single physical system.

	Generator Rating, Dec. 31, 1939				Source of Energy, 1939, Thous. Kw.-Hr.			Disposal of Energy in Thousands Kw.-Hr.					Distribution of Sales to Ultimate Consumers in Thousands of Kilowatt-Hrs.							Number of Customers, Dec. 31, 1939						Line No.
	Fuel Burning		Hydro												Commercial											
	No. of Plants	Rating of Generators Kw.	No. of Plants	Rating of Generators Kw.	Generated Net	Received by Purchase or Interchange, Net	Total Input Net	Used by Electric Railway Dept.	Used by Electric and Other Depts.	Lost and Unaccounted For	To Other Public Utilities	Sales to Ultimate Consumers	Farm, or Farm and Rural	Domestic Service	Small Light and Power (Retail)	Large Light and Power (Wholesale)	Municipal Street Light and Other Public	Railways and Electrified Railroads	Other Sales to Ultimate Consumers	Farm or Rural	Domestic	Commercial Small Light and Power	Commercial Large Light and Power	Other Ultimate Consumers	Total	
	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)
dated)	u 17	396,430	u 25	314,584	1,916,189	574,747	2,490,936	27,104	57,878	324,412	603,313	1,478,229	3,103	283,994	(c)	c1,134,757	42,120	14,255	0	1,218	454,701	(c)	c 71,650	215	527,784	1
	2	388,860	2	300	1,303,185	150,180	1,453,365	0	13,712	186,268	351,567	901,818	5,342	246,201	201,524	401,792	32,038	14,921	0	a 2,306	a339,604	a 71,576	a 850	a 118	a414,454	2
	2	130,000	9	64,625	625,919	154,189	780,108	0	7,378	105,388	121,013	546,329	(f)	154,267	57,880	304,584	11,087	18,511	0	(f)	148,268	18,152	1,905	0	168,325	3
	2	164,000	1	1,500	559,362	12,087	571,449	0	1,897	27,300	268,805	273,447	(f)	81,942	77,482	91,992	8,433	13,598	0	(f)	63,452	10,113	210	25	73,800	4
	5	18,747	24	114,350	537,245	27,867	565,112	H 4,719	32,815	72,575	46,509	408,494	8,912	46,918	29,525	307,540	4,748	3,185	7,666	10,956	64,410	10,885	1,981	1,487	89,719	5
	3	61,000	7	99,050	327,282	157,354	484,636	0	6,448	72,694	80,113	325,381	(f)	f 69,305	51,772	182,456	8,697	11,434	1,717	(f)	f 80,037	13,293	1,910	44	95,284	6
	1	75,000	0	0	460,346	6,483	466,829	0	0	0	466,829	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7
	2	160,000	0	0	409,369	0	409,369	0	2,590	44,799	13,776	348,204	(f)	f 83,148	73,549	183,531	7,976	0	0	(f)	f 116,224	15,916	3,466	15	135,621	8
	5	63,450	31	62,994	301,052	12,540	313,592	3,731	5,548	41,873	84,221	178,219	8,217	37,523	22,319	101,059	5,134	19	l 3,948	8,974	52,768	8,636	1,073	981	72,432	9
	1	38,740	2	10,600	165,521	147,243	312,764	0	3,415	34,090	130,338	144,921	(f)	55,469	23,519	61,697	3,961	0	275	(f) (a)	a 49,229	a 7,467	a 1,673	a 1	a 58,370	10
	1	92,000	0	0	237,308	0	237,308	0	2,249	20,649	42,664	171,746	847	18,498	11,876	136,485	2,820	0	1,220	480	37,942	4,513	722	272	43,929	11
	1	33,500	4	1,850	25,231	207,111	232,342	0	1,905	27,568	5,858	197,011	(f)	f 24,220	17,723	148,135	3,057	0	3,876	(f)	f 45,661	5,566	501	223	51,951	12
	2	36,000	11	30,075	170,775	39,281	210,056	9,939	4,410	27,495	12,910	155,302	2,099	33,058	46,147	68,411	3,879	409	1,299	2,062	44,936	8,986	12	472	56,468	13
	0	0	2	28,400	172,836	0	172,836	0	0	3,671	5,997	163,168	0	0	0	163,168	0	0	0	0	0	0	1	0	1	14
	1	22,750	0	0	97,628	34,812	132,440	0	1,152	5,181	12,635	113,472	.....	19,026	23,305	65,802	3,840	0	1,499	.....	29,732	5,221	152	138	35,243	15
	0	0	12	35,960	130,898	14	130,912	2,558	1,088	22,843	12,958	91,465	(f)	f 19,781	13,670	55,781	1,802	.....	431	(f)	f 25,566	5,177	942	75	31,760	16
	1	39,000	0	0	99,672	2,203	101,875	0	2,334	6,284	32,971	60,286	.....	19,799	9,015	24,339	5,349	1,624	160	.....	34,290	5,257	510	47	40,104	17
	46	1,719,477	130	764,288	7,539,818	1,526,111	9,065,929	48,051	144,819	1,023,090	2,292,477	5,557,492	28,520	1,193,149	659,306	3,431,529	144,941	77,956	22,091	25,996	1,586,820	190,758	87,558	4,113	1,895,245	
	6	596,850	90	979,788	6,171,113	1,447,480	7,618,593	2,535	79,783	892,669	1,189,926	5,453,680	53,443	558,614	712,552	3,946,884	83,514	64,086	34,587	44,056	590,415	88,007	2,432	829	725,739	18
nc. (D)	10	2,566,300	0	0	7,135,709	241,145	7,376,854	0	68,375	898,684	7	6,409,788	0	1,242,588	1,552,591	1,967,551	164,637	1,202,861	279,560	0	a1,974,264	a407,473	a 24,296	a 3,459	a2,409,492	19
	8	872,360	3	253,765	4,345,918	—92,497	4,253,421	0	k 13,464	421,079	221,741	3,597,137	w 15,914	577,394	460,388	1,561,791	30,931	923,157	27,562	w 9,791	595,853	121,395	1,718	535	729,292	20
	5	737,700	0	0	2,875,802	119,145	2,994,947	k 96,344	27,054	388,022	3,364	2,480,163	(f)	f 564,388	f 631,148	1,184,600	66,688	33,339	0	(f)	f 799,264	f 159,928	1,086	225	960,503	21
Inc	28	570,410	u 11	57,390	2,412,663	57,900	2,470,563	32,082	15,378	313,046	22,798	2,087 259	(f)	f 299,229	209,969	1,538,225	22,880	16,956	[0	(f)	f 353,308	48,811	3,693	431	406,243	22
	u 4	504,000	0	0	2,003,631	4,149	2,007,780	0	5,811	174,615	233	1,827,121	.....	296,827	148,476	1,160,557	27,841	193,420	0	.....	310,044	33,513	3,046	111	346,714	23
	16	346,812	20	44,877	1,613,966	260,629	1,874,595	0	k 4,097	231,472	13,462	1,625,564	31,306	222,962	181,900	1,088,790	21,834	31,710	47,062	25,519	321,467	51,822	3,489	3,054	405,351	24
Corp	1	20,000	2	291,000	1,300,977	b 18,218	1,319,195	0	0	52,178	1,107,761	159,256	0	0	0	0	0	159,256	0	0	0	0	0	1	1	25
)	10	101,403	15	22,880	485,312	453,990	939,302	778	5,458	129,856	136,139	667,071	33,011	169,856	123,429	283,695	23,819	461	32,800	29,277	200,466	29,645	1,947	4,170	265,505	26
	3	169,000	4	21,928	499,504	233,993	733,497	0	9,659	87,549	94,868	541,421	11,431	74,790	48,096	381,088	6,437	11,407	8,172	9,477	95,074	14,532	2,362	953	122,398	27
	6	114,975	10	48,375	439,915	32,178	472,093	0	18,547	63,961	2,780	386,805	8,729	83,433	111,913	129,814	21,037	17,084	l 14,795	9,021	111,897	13,806	825	1,109	136,658	28
	4	57,100	0	0	326,327	71,344	397,671	0	4,609	80,101	32,096	280,865	5,811	57,668	46,791	158,329	3,943	1,800	6,523	6,723	85,358	12,113	1,359	954	106,507	29
	6	239,100	0	0	389,086	17	389,103	0	8,699	64,445	12,307	303,652	.....	129,044	68,082	62,575	24,649	14,136	5,166	.....	149,595	19,689	4,102	249	173,635	30
	5	137,300	1	350	385,110	—34,960	350,150	0	6,619	54,788	7,085	281,658	w 1,933	75,081	42,380	138,224	9,190	12,028	2,822	w 447	92,781	13,823	883	150	108,084	31
	2	m 120,000	0	0	347,090	37	347,127	0	3,986	42,963	3,980	296,198	8,569	62,743	57,440	133,336	10,279	9,135	k 14,696	a 6,020	a 74,821	a 14,304	a 89	a 1,230	a 96,464	32
	3	76,100	2	4,100	287,389	b 24,214	311,603	0	1,416	41,355	45,411	223,421	6,592	35,568	18,187	148,791	2,746	7,865	3,672	7,983	48,684	6,215	1,941	607	65,430	33
	1	12,000	5	23,480	74,763	231,669	306,432	0	7,962	37,263	56,077	205,130	13,206	51,625	41,152	91,723	7,424	0	0	6,536	59,443	11,746	136	81	77,942	34
	3	m 117,700	0	0	303,703	2,116	305,819	0	1,947	25,729	14,939	263,204	810	49,746	33,189	160,754	4,652	11,063	k 2,990	917	72,448	9,432	262	444	83,503	35
	2	37,500	0	0	85,036	169,981	255,017	0	82	22,861	7,699	224,375	.....	42,800	30,349	146,088	3,023	2,115	0	.....	44,832	5,629	65	33	50,559	36
	1	55,000	1	270	339,523	—134,921	204,602	0	1,564	27,774	8,110	167,154	8,957	33,907	19,948	92,732	3,623	7,976	11	3,744	43,078	6,215	662	165	53,864	37
	1	46,000	0	0	130,034	10,767	140,801	0	2,367	16,756	1,840	119,838	132	33,623	18,054	35,695	7,073	16,294	8,967	102	41,238	6,240	131	491	48,202	38
	2	55,000	0	0	207,848	—73,986	133,862	0	1,604	12,154	1,142	118,962	918	18,440	13,200	76,809	2,456	6,869	270	1,636	32,454	3,476	118	36	37,720	39
	127	7,552,610	164	1,748,203	32,160,419	3,042,608	35,203,027	131,739	288,481	4,079,320	2,983,765	27,719,722	200,762	4,680,326	4,569,234	14,488,051	548,676	2,743,018	489,655	161,249	6,096,784	1,077,814	54,642	19,317	7,409,806	
es																										
)	14	1,998,000	6	7,765	7,550,378	11,240	7,561,618	0	(v)	v 876,811	1,045,839	5,638,968	40,755	1,046,841	760,385	2,673,023	226,267	891,697	0	29,212	1,178,480	154,992	4,933	535	1,368,152	40
ystem)	22	m 938,488	18	190,338	4,785,726	—26,195	4,759,531	0	28,844	521,478	590,101	3,619,108	52,017	439,770	312,206	2,697,312	29,617	14,569	k 73,617	a 51,178	a510,499	a 79,437	a 2,131	a 6,431	a649,676	41
	7	1,011,375	7	9,300	3,121,235	6,734	3,127,969	0	32,509	334,996	108,263	2,652,201	31,205	j 565,394	597,359	1,359,623	24,546	39,141	34,933	31,225	562,844	78,777	491	480	673,817	42
(A)	4	523,750	0	0	1,808,565	11,581	1,820,146	0	8,302	212,492	15,944	1,583,408	10,360	255,679	o 216,255	o 926,172	17,200	149,199	8,543	7,700	279,373	42,277	789	496	330,635	43
	8	325,900	43	147,815	1,591,549	141,571	1,733,120	0	2,390	288,471	28,488	1,413,771	.....	433,375	285,505	657,881	21,886	3,873	s 11,251	.....	383,915	61,065	658	393	446,031	44
. (D)	5	511,750	0	0	1,605,971	—33,662	1,572,309	11,638	21,599	164,919	114,098	1,260,055	(f)	f 289,823	187,028	602,399	93,017	87,788	0	(f)	f 317,682	41,463	5,883	2,292	367,320	45
os. (D)	u 8	n 508,610	u 13	36,870	1,504,875	45,377	1,550,252	2,250	17,445	220,636	48,185	1,261,736	31,976	290,118	187,118	593,009	37,835	99,573	22,107	23,399	284,779	42,776	619	1,211	352,784	46
	5	331,500	1	1,950	1,137,032	52,100	1,189,132	0	4,640	121,422	241,922	821,148	.....	207,010	165,111	415,380	14,754	17,799	s 1,094	.....	178,958	19,863	279	79	199,179	47
	6	129,230	2	4,290	713,968	145,738	859,706	0	5,658	121,536	293,254	439,258	5,972	78,442	66,283	200,045	10,154	64,640	13,722	7,044	115,534	21,660	2,453	1,915	148,606	48
	3	96,100	9	19,355	309,601	489,715	799,316	0	11,970	86,164	125,605	575,577	11,811	53,534	34,550	427,240	6,712	29,055	k 12,675	7,630	73,094	11,691	1,905	1,109	95,429	49
	8	129,100	0	0	555,515	100,173	655,688	767	3,064	70,749	72,674	508,434	14,660	69,747	57,581	358,973	7,473	0	0	14,672	77,221	12,147	344	38	104,422	50
	4	175,280	1	5,000	479,939	73,240	553,179	0	3,756	67,956	12,567	468,900	10,151	84,949	86,013	266,435	11,357	9,995	0	11,317	93,506	14,560	258	52	119,693	51
	4	184,000	0	0	521,827	500	522,327	0	6,791	50,788	2,238	462,510	.....	104,898	97,760	239,592	18,572	0	1,688	.....	111,297	13,852	305	11	125,465	52
	2	75,000	0	0	240,317	250,858	491,175	0	20,944	82,681	49,861	337,689	9,202	79,812	55,909	172,808	9,772	0	10,186	7,350	128,718	26,509	4,608	503	167,688	53
	16	183,350	0	0	447,522	8,839	456,361	22,610	4,073	66,196	21,080	342,402	7,510	90,869	88,967	139,764	2,975	0	12,317	12,355	117,094	17,139	978	1,068	148,634	54
(D)	4	41,250	20	65,436	384,035	5,633	389,668	1,992	3,250	63,456	56,467	264,503	16,372	49,815	45,315	143,874	6,521	0	2,606	14,745	62,284	12,594	419	176	90,218	55
	4	113,500	0	0	385,670	3,201	388,871	0	1,899	34,324	2,727	349,921	.....	65,457	60,418	218,946	4,926	0	s 174	.....	62,100	9,223	196	34	71,553	56
	6	50,604	30	39,591	325,085	22,761	347,846	344	6,358	60,621	91,635	188,888	17,464	60,627	59,543	43,425	7,093	0	736	16,954	78,989	17,230	99	242	113,514	57
	2	17,000	1	384	898	271,129	272,027	0	1,107	50,002	32,619	188,299	6,439	27,317	22,103	123,843	3,203	0	5,394	6,169	44,602	8,572	1,067	831	61,241	58
sion	1	80,000	0	0	206,422	6,220	212,642	0	115,400	13,176	0	84,066	0	0	260	13,027	0	70,779	0	0	0	15	15	1	31	59
	0	0	1	35,000	70,920	140,446	211,366	0	819	4,673	0	205,874	0	0	0	1,013	122,552	0	o 82,309	0	0	0	9	5	14	60
	1	31,000	0	0	58,648	139,595	198,243	11,747	558	14,947	20,585	150,406	2,536	17,550	18,878	105,315	615	3,006	2,506	2,955	18,224	3,001	871	234	25,285	61

NOTES

(1) In a number of instances, reports indicated that the allocations of energy and customers were estimated. To avoid additional notes, estimated quantities have not been specially marked.

(2) Where companies do not classify sales under the exact heads used in this table, items reported were entered under the most nearly appropriate caption. For instance, it was impracticable to distinguish among residential, urban, domestic.

a Line 2 — Bills rendered in December. (10, 127) Meters. (19, 72) Aver. no. bills rendered. (32, 41) No. of customer accounts. (109, 133, 153) Aver. no of customers.

b Line 25 — Interch. sold 82,909, purch. 101,127. (33) Penna. Elec., 22,769. (97) Territorial deliveries after deducting del. to other elec. cos. were 158,786.

d Retail combined with wholesale.

e Canadian Niagara Power Co., Ltd. (see Canada), included in Niagara Hudson Power Corp. System.

f Farm or rural combined with other.

g Duke Power Co., Hydro-E.P. Comm. of Ontario, Canadian Niag. P. not included because of lack of data.

h Transferred to affiliated transportation co.

j Includes water heater service (off-peak).

k Lines 20, 24, 71, 89, 111, 126, 132, 136, 142, 146 — Incl. free service (franchise re-

52	[illegible]	4	184,000	0	0	521,827	500	522,327	0	6,791	30,788	2,238	462,310	.....	104,898	97,760	239,592	18,572	0	1,688	.....	111,297	13,852	305	11	125,465	52
53	Central Illinois Public Service Co.	2	75,000	0	0	240,317	250,858	491,175	0	20,944	82,681	49,861	337,689	9,202	79,812	55,909	172,808	9,772	0	10,186	7,350	128,718	26,509	4,608	503	167,688	53
54	Columbus and Southern Ohio Elec. Co.	16	183,350	0	0	447,522	8,839	456,361	22,610	4,073	66,196	21,080	342,402	7,510	90,869	88,967	139,764	2,975	0	12,317	12,355	117,094	17,139	978	1,068	148,634	54
55	Wisconsin Public Service Corp. and Sub. (*D*)	4	41,250	20	65,436	384,035	5,633	389,668	1,992	3,250	63,456	56,467	264,503	16,372	49,815	45,315	143,874	6,521	0	2,606	14,745	62,284	12,594	419	176	90,218	55
56	Central Illinois Light Co.	4	113,500	0	0	385,670	3,201	388,871	0	1,899	34,324	2,727	349,921	.....	65,457	60,418	218,946	4,926	0	*s* 174	.....	62,100	9,223	196	34	71,553	56
57	Wisconsin Power & Light Co.	6	50,604	30	39,591	325,085	22,761	347,846	344	6,358	60,621	91,635	188,888	17,464	60,627	59,543	43,425	7,093	0	736	16,954	78,989	17,230	99	242	113,514	57
58	Northern Indiana Power Co.	2	17,000	1	384	898	271,129	272,027	0	1,107	50,002	32,619	188,299	6,439	27,317	22,103	123,843	3,203	0	5,394	6,169	44,602	8,572	1,067	831	61,241	58
59	City of Detroit Public Lighting Commission	1	80,000	0	0	206,422	6,220	212,642	0	115,400	13,176	0	84,066	0	0	260	13,027	0	70,779	0	0	0	15	15	1	31	59
60	The Sanitary District of Chicago	0	0	1	35,000	70,920	140,446	211,366	0	819	4,673	0	205,874	0	0	0	1,013	122,552	0	*o* 82,309	0	0	0	9	5	14	60
61	Indiana Service Corp.	1	31,000	0	0	58,648	139,595	198,243	11,747	558	14,947	20,585	150,406	2,536	17,550	18,878	105,315	615	3,006	2,506	2,955	18,224	3,001	871	234	25,285	61
62	City of Cleveland, Dept. of Public Utilities	1	50,000	0	0	183,260	0	183,260	0	0	20,533	2,135	160,592	.....	37,979	37,757	54,286	30,570	0	0	.....	45,641	8,584	192	1	54,418	62
63	Southern Indiana Gas and Electric Co.	3	62,800	0	0	149,787	0	149,787	592	1,173	17,420	173	130,429	.....	27,382	35,792	62,828	3,083	1,344	0	.....	34,886	4,394	62	11	39,353	63
64	City of Lansing, Bd. Water & Elec. Lt. Commrs.	2	58,750	2	1,200	139,758	341	140,099	0	642	8,605	0	130,852	.....	35,005	30,995	60,443	4,409	0	0	.....	25,332	3,321	60	2	28,715	64
65	Central Illinois Electric and Gas Co.	4	46,238	1	1,200	44,034	89,046	133,080	336	5,328	15,049	0	112,367	2,420	29,175	22,753	48,170	3,992	0	5,857	2,363	37,272	5,378	562	340	45,915	65
66	The Marion-Reserve Power Co.	1	27,000	0	0	61,233	68,091	129,324	0	581	14,997	17,956	95,790	8,891	16,988	13,439	51,260	2,346	0	2,866	11,669	24,856	5,260	872	613	43,270	66
67	Lake Superior District Power Co.	3	16,490	9	14,298	102,989	9,168	112,157	0	561	16,091	6,825	88,680	1,465	13,970	8,554	62,820	1,227	0	644	1,929	15,698	3,633	50	264	21,474	67
	Totals for section	148	7,716,065	164	579,792	28,486,759	2,033,440	30,520,199	52,276	309,661	3,621,189	3,001,241	23,535,832	293,725	4,471,526	3,553,837	12,718,906	722,674	1,482,458	292,706	259,866	4,862,878	719,413	31,108	19,367	5,892,632	
	West North Central States																										
68	Union Electric Co. of Missouri and Subs.	5	455,420	2	237,000	2,468,396	26	2,468,422	953	9,558	317,402	401,412	1,739,097	(*f*)	309,988	237,653	1,020,298	34,102	123,507	13,549	(*f*)	307,563	41,061	394	59	349,077	68
69	Northern States Power Co. (Minn.) and Sub.	19	327,326	25	129,335	1,364,098	97,303	1,461,401	0	12,746	227,096	74,329	1,147,230	11,842	363,805	235,239	500,210	32,022	4,110	2	8,654	331,753	48,026	21,436	345	410,214	69
70	Kansas City Power & Light Co.	20	283,925	0	0	780,572	2,289	782,861	0	8,433	70,632	48,247	655,549	5,441	125,193	156,363	242,950	13,595	81,677	30,330	4,769	129,694	22,796	214	931	158,404	70
71	Minnesota Power & Light Co.	5	30,420	11	94,911	435,205	1,148	436,353	0	*k* 2,369	64,074	56,275	313,635	1,831	37,325	41,754	220,848	3,117	8,760	0	2,395	41,128	7,082	449	69	51,123	71
72	Nebraska Power Co.	*T* 2	*T* 111,500	0	0	413,407	396	413,803	0	2,012	36,762	20,474	354,555	8,116	68,804	(*d*)	*d* 210,871	8,602	25,994	32,168	*a* 5,220	*a* 71,845	(*d*)	*a,d* 11,602	*a* 671	*a* 89,338	72
73	Kansas Gas and Electric Co.	3	89,000	0	0	304,985	48	305,033	0	2,199	40,474	18,510	243,850	4,729	48,254	49,171	131,790	2,838	695	6,373	4,201	58,684	8,231	822	770	72,708	73
74	The Empire District Electric Co.	1	66,500	4	26,720	270,506	—2,269	268,237	0	1,083	53,294	72,574	141,286	2,150	13,498	17,213	106,223	2,202	0	0	2,267	21,918	5,224	778	47	30,234	74
75	Des Moines Electric Light Co. (*D*)	2	107,000	1	400	244,459	0	244,459	0	1,507	34,272	22,935	186,195	3,425	46,117	33,325	88,708	6,167	0	8,453	2,963	52,435	8,681	172	458	64,709	75
76	Sioux City G. & El. Co.— Iowa P. S. Co. System	22	87,946	4	2,051	234,641	7,386	242,027	0	5,068	35,413	17,402	184,144	5,230	46,900	*d* 111,610	(*d*)	6,808	4,592	9,004	6,937	66,496	*d* 16,985	(*d*)	366	90,784	76
77	Iowa Electric Light and Power Co.	10	58,803	2	1,460	202,923	1,096	204,019	3,375	2,256	22,307	37,753	138,328	4,792	32,371	24,155	74,138	2,872	0	0	4,658	41,241	9,619	291	93	55,902	77
78	Interstate Power Co.	16	66,654	13	7,265	170,103	33,257	203,360	0	1,630	37,729	27,831	136,170	5,077	44,504	50,886	22,946	5,728	498	6,531	4,372	60,913	18,150	55	465	83,955	78
79	Kansas City, Kansas, Board of Public Utilities	1	69,000	0	0	155,988	0	155,988	0	*o* 16,299	14,838	0	124,851	.....	28,034	18,625	74,275	3,203	714	0	.....	29,609	4,042	62	1	33,714	79
80	Iowa-Nebraska Light and Power Co.	39	45,100	17	2,235	127,312	28,452	155,764	0	2,839	20,889	14,367	117,669	3,217	35,581	38,960	31,733	2,914	999	4,265	3,144	48,064	11,769	59	310	63,346	80
81	Laclede Power & Light Co.	3	46,500	0	0	155,022	63	155,085	0	45	20,887	0	134,153	0	28,206	15,101	90,241	0	0	605	0	30,342	3,880	1,204	0	35,426	81
82	Iowa Southern Utilities Co.	5	25,107	0	0	66,457	51,949	118,406	315	0	21,278	7,612	89,201	7,031	27,283	24,604	27,616	2,667	0	0	3,391	41,794	10,004	351	111	55,651	82
83	Otter Tail Power Co.	7	37,978	5	4,930	104,248	62	104,310	.....	294	24,232	16,420	63,364	800	27,808	25,958	5,580	3,218	0	0	711	29,240	10,505	15	317	40,788	83
	Totals for section	160	1,908,179	84	506,307	7,498,322	221,206	7,719,528	4,643	67,888	1,041,579	836,141	5,769,277	63,681	1,283,671	1,080,617	2,848,427	130,055	251,546	111,280	53,682	1,362,719	226,055	37,904	5,013	1,685,373	
	South Atlantic States																										
84	Duke Power Co. (*g*)	.....	.....	.....	.....	*g*2,363,375	395,872	*O* 2,759,247	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	84
85	Georgia Power Co.	19	94,439	22	287,500	1,361,023	689,336	2,050,359	50,675	11,599	338,420	155,692	1,493,973	.....	250,721	258,457	965,509	18,198	1,088	0	.....	179,331	39,252	497	328	219,408	85
86	Cons. Gas Electric Light & Power Co., Baltimore	4	250,950	0	0	701,979	944,058	1,646,037	0	2,778	*x* 150,221	*x* 9,705	1,483,333	(*f*)	*f* 203,742	243,096	722,580	15,388	279,942	18,585	(*f*)	*f* 247,907	40,815	225	27	288,974	86
87	Potomac Electric Power Co.	2	255,000	0	0	1,103,820	—110,681	993,139	0	6,723	112,716	15,284	858,416	(*f*)	*f* 200,491	220,714	326,903	26,225	84,083	0	(*f*)	*f* 169,818	27,051	322	39	197,230	87
88	Carolina Power & Light Co.	2	43,000	10	206,050	684,979	238,302	923,281	0	2,303	192,988	131,600	596,390	13,141	97,364	*d* 456,672	(*d*)	6,082	0	23,131	14,345	76,324	*d* 19,655	(*d*)	1,826	112,150	88
89	Virginia Electric and Power Co.	2	141,000	7	30,535	754,857	19,425	774,282	33,133	*k* 7,786	85,508	27,945	619,910	(*f*)	*f* 152,011	154,789	285,528	4,138	352	23,092	(*f*)	*f* 133,738	23,834	787	1,003	159,362	89
90	Florida Power & Light Co.	37	139,028	0	0	417,099	1,846	418,945	0	13,272	80,517	177	324,979	8,011	123,349	122,435	38,299	29,348	3,537	0	1,846	110,805	26,715	834	1,608	141,808	90
91	Virginia Public Service Co.	8	83,402	10	15,106	347,382	9,343	356,725	4,010	8,340	56,325	13,126	274,924	9,480	76,271	49,658	102,461	4,759	5	32,290	6,388	82,746	14,204	515	617	104,470	91
92	South Carolina Electric & Gas Co.	1	*n* 72,500	2	24,630	289,922	43,642	333,564	0	5,187	33,393	148,200	146,784	2,110	15,934	20,085	104,585	1,420	0	2,650	1,749	16,487	4,862	237	111	23,446	92
93	Lexington Water Power Co.	0	0	1	130,000	237,285	52,507	289,792	0	8	3,558	286,226	0	0	0	0	0	0	0	0	0	0	0	0	0	0	93
94	Florida Power Corp.	5	44,631	3	14,193	192,917	33,488	226,405	0	2,053	47,419	102,649	74,284	1,954	30,144	22,390	16,106	751	0	2,939	1,289	31,372	6,745	204	346	39,956	94
95	Delaware Power & Light Co.	1	*T* 22,500	0	0	205	220,502	220,707	0	1,360	16,477	12,129	190,741	(*f*)	*f* 33,148	*y* 42,961	*z* 100,234	2,816	11,096	486	(*f*)	*f* 34,797	*y* 6,582	*z* 196	24	41,599	95
96	Tampa Electric Co.	2	42,500	0	0	187,584	0	187,584	8,258	3,732	25,492	819	149,283	1,990	26,919	23,386	92,147	2,457	0	2,384	1,634	36,314	6,753	70	317	45,088	96
97	South Carolina Power Co.	4	19,570	1	23,600	136,866	44,914	*b* 181,780	0	1,104	22,898	26,311	131,467	.....	32,384	24,241	72,756	2,086	0	0	.....	23,882	6,466	103	43	30,494	97
98	Jacksonville Municipal Light Plant	1	81,500	0	0	159,286	0	159,286	0	0	19,641	3,753	135,892	.....	42,168	40,221	43,972	7,963	0	1,568	.....	34,685	7,301	134	914	43,034	98
99	Florida Public Service Co.	3	28,228	0	0	88,950	12,427	101,377	0	7,230	18,324	5,719	70,104	2,913	14,621	7,923	41,643	965	0	2,039	1,081	13,300	2,877	163	384	17,805	99
	Totals for section (*g*)	*g* 91	*g*1,318,248	*g* 56	*g* 731,614	*g*6,664,154	*g*2,199,109	*g*8,863,263	96,076	73,475	1,203,897	939,335	6,550,480	39,599	1,299,267	1,687,028	2,912,723	122,596	380,103	109,164	28,332	1,191,506	233,112	4,287	7,587	1,464,824	
	East South Central States																										
100	Tennessee Valley Authority	23	227,655	19	610,709	2,748,769	8,197	2,756,966	0	178,132	207,148	*z*1,381,183	990,503	1,670	12,376	6,374	969,592	245	0	246	1,982	7,004	1,929	19	15	10,949	100
101	Agencies Distributing TVA Power (Consol. Rep't)	0	0	0	0	0	944,123	944,123	0	0	139,460	0	804,663	24,401	182,696	146,693	403,035	11,829	0	36,009	40,466	255,586	57,480	814	443	354,789	101
102	Alabama Power Co.	12	165,379	6	414,500	2,425,857	170,971	2,596,828	986	5,630	321,782	1,127,055	1,141,375	.....	152,505	121,652	859,546	7,672	0	0	.....	123,597	26,646	619	268	151,130	102
103	Louisville Gas and Electric Co. (Ky.) and Subs.	2	129,500	1	80,320	428,199	49,466	477,665	0	5,085	48,347	77,990	346,243	.....	72,538	*y* 56,858	*z* 151,189	8,550	33,799	*k* 23,309	.....	86,920	*y* 11,290	*z* 3,539	599	102,348	103
104	Kentucky Utilities Co. (Consolidated) (*D*)	10	72,700	2	30,540	342,618	95,341	437,959	0	7,962	65,046	65,827	299,124	7,416	53,157	54,710	164,615	5,950	0	13,276	6,174	72,347	15,488	1,432	1,243	96,684	104
105	Birmingham Electric Co.	1	11,300	0	0	(*m*)	332,958	332,958	31,831	1,960	36,049	0	263,118	.....	56,481	64,510	137,302	2,972	0	*k* 1,853	.....	68,096	8,776	199	282	77,353	105
106	Mississippi Power & Light Co.	25	15,170	0	0	14,587	224,541	239,128	0	1,251	37,193	13,577	187,107	3,753	33,044	58,881	91,429	0	0	0	1,720	43,080	11,553	1,315	0	57,668	106
107	Mississippi Power Co.	10	17,490	0	0	18,137	178,372	196,509	0	1,004	33,260	3,826	158,419	.....	31,805	42,853	80,534	3,190	37	0	.....	28,740	7,686	85	82	36,593	107
	Totals for section	83	639,194	28	1,136,069	5,978,167	2,003,969	7,982,136	32,817	201,024	888,285	2,669,458	4,190,552	37,240	594,602	552,531	2,857,242	40,408	33,836	74,693	50,342	685,370	140,848	8,022	2,932	887,514	
	West South Central States																										
108	Louisiana Power & Light Co.	11	86,868	0	0	642,245	103,057	745,302	0	2,812	53,783	426,539	262,168	4,117	20,257	16,610	213,579	7,605	0	0	3,804	33,519	7,007	450	671	45,451	108
109	Houston Lighting & Power Co.	4	206,586	0	0	719,041	21,234	740,275	0	3,407	79,435	24,369	633,064	2,193	103,238	173,859	299,141	4,715	11,022	38,896	*a* 1,171	*a*119,439	*a* 17,430	*a* 743	*a* 865	*a*139,648	109
110	Gulf States Utilities Co.	8	181,516	0	0	722,719	1,945	724,664	0	8,625	*k* 67,311	18,362	630,366	*w* 203	69,211	64,438	488,033	2,393	0	0	*w* 30	71,259	13,862	492	99	85,742	110
111	Oklahoma Gas and Electric Co.	14	*T* 170,176	0	0	629,524	22,935	652,459	0	*k* 6,175	96,090	10,117	540,077	*w* 19,168	90,120	98,025	288,503	8,058	12,094	24,109	*w* 9,800	119,960	24,601	7,416	1,800	163,577	111
112	Texas Power & Light Co.	9	96,940	0	0	587,980	50,067	638,047	0	(*p*)	*p* 122,308	91,683	424,056	8,974	70,442	74,582	218,938	*l* 34,788	16,332	0	10,562	99,044	20,809	2,854	*l* 1,996	135,265	112
113	Arkansas Power & Light Co.	17	42,030	3	65,968	162,599	334,110	496,709	0	7,331	80,208	61,408	347,762	3,650	43,465	52,636	226,563	*l* 16,451	4,997	0	4,807	60,330	17,088	768	*l* 1,535	84,528	113
114	Texas Electric Service Co.	11	98,126	0	0	475,521	3,900	479,421	0	(*p*)	*p* 87,952	17,725	373,744	2,787	60,208	89,918	184,897	30,629	5,305	0	2,526	77,301	13,250	1,304	873	95,254	114
115	New Orleans Public Service, Inc.	1	138,000	0	0	470,042	0	470,042	34,938	4,383	38,969	91,676	300,076	.....	58,752	99,146	111,898	12,176	0	18,104	.....	93,925	14,729	1,396	573	110,623	115
116	Dallas Power & Light Co.	2	113,750	0	0	344,249	—22	344,227	0	3,637	36,566	0	304,024	390	71,342	130,437	42,150	7,469	27,557	24,679	238	76,583	9,090	927	408	87,246	116
117	Central Power and Light Co.	28	61,503	5	15,000	287,352	33,553	320,905	0	25,524	61,890	17,634	215,857	7,626	43,779	62,964	90,514	2,440	0	8,534	5,297	51,475	18,543	1,095	314	76,724	117
118	Southwestern Gas & Electric Co.	9	55,515	0	0	255,263	56,646	311,909	0	6,707	41,406	16,496	247,300	.....	51,006	88,772	86,865	3,923	8,565	8,169	.....	62,625	14,824	84	1,056	78,589	118
119	Public Service Co. of Okla.	11	99,241	0	0	256,676	35,011	291,687	0	2,603	38,056	25,161	225,867	1,795	49,582	27,998	136,967	2,959	705	5,861	1,255	60,098	10,993	1,975	543	74,864	119
120	West Texas Utilities Co.	16	52,442	0	0	267,994	6,479	274,473	0	9,618	44,345	77,768	142,742	1,101	37,335	32,545	62,767	1,888	22	7,084	689	38,079	11,302	956	855	51,881	120
121	San Antonio Public Service Co.	10	98,300	3	1,100	233,108	27,303	260,411	0	2,073	33,529	15,742	209,067	3,235	44,890	82,533	52,503	2,232	0	23,674	1,896	64,283	11,479	204	266	78,128	121
122	El Paso Electric Co.	4	56,529	0	0	142,932	357	143,289	4,372	1,244	16,367	10,785	110,521	2,445	21,024	*y* 23,082	*z* 51,765	1,165	0	11,040	1,493	19,949	*y* 3,354	*z* 123	121	25,040	122
123	Panhandle Power & Light Co.	3	30,000	0	0	107,582	28	107,610	0	305	8,848	2,575	95,882	265	1,765	2,449	90,423	35	.....	945	180	2,718	954	41	219	4,112	123
	Totals for section	158	1,587,522	11	82,068	6,304,827	696,603	7,001,430	39,310	84,444	907,063	908,040	5,062,573	57,949	836,416	1,119,994	2,645,506	138,926	86,599	177,183	43,748	1,050,587	209,315	20,828	12,194	1,336,672	
	Rocky Mountain States																										
124	Bureau of Reclamation (Boulder Dam)	0	0	1	704,800	2,507,932	0	2,507,932	0	15,353	22,519	2,464,353	5,707	0	2,738	1,605	.....	.....	.....	1,364	0	575	72	.....	2	649	124
125	The Montana Power Co.	0	0	12	342,000	1,525,301	—33,505	1,491,796	0	(*p*)	*p* 175,493	14,218	1,302,085	3,801	59,915	55,378	875,848	8,593	91,072	207,478	2,847	70,426	10,946	1,114	1,300	86,633	125
126	Utah Power & Light Co.	6	61,985	29	178,192	506,098	434,400	940,498	0	*k* 6,608	154,267	9,763	769,860	16,217	93,332	*d* 626,156	(*d*)	7,720	20,340	6,095	16,002	82,571	*d* 12,179	(*d*)	265	111,017	126
127	Idaho Power Co.	2	535	13	101,875	732,092	34,457	766,549	0	4,681	89,057	443,590	229,221	26,875	67,708	59,122	72,623	2,893	0	0	*a* 14,431	*a* 38,475	*a* 10,488	*a* 175	*a* 52	63,621	127
128	Public Service Co. of Colorado	12	114,507	7	491,175	1,846,634	418,945	2,265,579	0	13,272	80,517	177	324,979	8,011	123,349	122,435	38,299	29,348	3,537	0	1,846	110,805	26,715	834	1,608	141,808	128

2	75,000	0	0	240,317	250,858	491,175	0	20,944	82,681	49,861	337,689	9,202	79,812	55,909	172,808	9,772	0	10,186	7,350	128,718	26,509	4,608	503	167,688	53
1	183,350	0	0	447,522	8,839	456,361	22,610	4,073	66,196	21,080	342,402	7,510	90,869	88,967	139,764	2,975	0	12,317	12,355	117,094	17,139	978	1,068	148,634	54

k Transferred to affiliated

	2	75,000	0	0	240,317	250,858	491,175	0	20,944	82,681	49,861	337,689	9,202	79,812	55,909	172,808	9,772	0	10,186	7,350	128,718	26,509	4,608	503	167,688	53
	16	183,350	0	0	447,522	8,839	456,361	22,610	4,073	66,196	21,080	342,402	7,510	90,869	88,967	139,764	2,975	0	12,317	12,355	117,094	17,139	978	1,068	148,634	54
(D)	4	41,250	20	65,436	384,035	5,633	389,668	1,992	3,250	63,456	56,467	264,503	16,372	49,815	45,315	143,874	6,521	0	2,606	14,745	62,284	12,594	419	176	90,218	55
	4	113,500	0	0	385,670	3,201	388,871	0	1,899	34,324	2,727	349,921	.....	65,457	60,418	218,946	4,926	0	s 174	.....	62,100	9,223	196	34	71,553	56
	6	50,604	30	39,591	325,085	22,761	347,846	344	6,358	60,621	91,635	188,888	17,464	60,627	59,543	43,425	7,093	0	736	16,954	78,989	17,230	99	242	113,514	57
	2	17,000	1	384	898	271,129	272,027	0	1,107	50,002	32,619	188,299	6,439	27,317	22,103	123,843	3,203	0	5,394	6,169	44,602	8,572	1,067	831	61,241	58
on	1	80,000	0	0	206,422	6,220	212,642	0	115,400	13,176	0	84,066	0	0	260	13,027	0	70,779	0	0	0	15	15	1	31	59
	0	0	1	35,000	70,920	140,446	211,366	0	819	4,673	0	205,874	0	0	0	1,013	122,552	0	o 82,309	0	0	0	9	5	14	60
	1	31,000	0	0	58,648	139,595	198,243	11,747	558	14,947	20,585	150,406	2,536	17,550	18,878	105,315	615	3,006	2,506	2,955	18,224	3,001	871	234	25,285	61
es	1	50,000	0	0	183,260	0	183,260	0	0	20,533	2,135	160,592	.....	37,979	37,757	54,286	30,570	0	0	.....	45,641	8,584	192	1	54,418	62
	3	62,800	0	0	149,787	0	149,787	592	1,173	17,420	173	130,429	.....	27,382	35,792	62,828	3,083	1,344	0	.....	34,886	4,394	62	11	39,353	63
ommrs	2	58,750	2	1,200	139,758	341	140,099	0	642	8,605	0	130,852	.....	35,005	30,995	60,443	4,409	0	0	.....	25,332	3,321	60	2	28,715	64
	4	46,238	1	1,200	44,034	89,046	133,080	336	5,328	15,049	0	112,367	2,420	29,175	22,753	48,170	3,992	0	5,857	2,363	37,272	5,378	562	340	45,915	65
	1	27,000	0	0	61,233	68,091	129,324	0	581	14,997	17,956	95,790	8,891	16,988	13,439	51,260	2,346	0	2,866	11,669	24,856	5,260	872	613	43,270	66
	3	16,490	9	14,298	102,989	9,168	112,157	0	561	16,091	6,825	88,680	1,465	13,970	8,554	62,820	1,227	0	644	1,929	15,698	3,633	50	264	21,474	67
	148	7,716,065	164	579,792	28,486,759	2,033,440	30,520,199	52,276	309,661	3,621,189	3,001,241	23,535,832	293,725	4,471,526	3,553,837	12,718,906	722,674	1,482,458	292,706	259,866	4,862,878	719,413	31,108	19,367	5,892,632	
	5	455,420	2	237,000	2,468,396	26	2,468,422	953	9,558	317,402	401,412	1,739,097	(f)	309,988	237,653	1,020,298	34,102	123,507	13,549	(f)	307,563	41,061	394	59	349,077	68
Sub	19	327,326	25	129,335	1,364,098	97,303	1,461,401	0	12,746	227,096	74,329	1,147,230	11,842	363,805	235,239	500,210	32,022	4,110	2	8,654	331,753	48,026	21,436	345	410,214	69
	20	283,925	0	0	780,572	2,289	782,861	0	8,433	70,632	48,247	655,549	5,441	125,193	156,363	242,950	13,595	81,677	30,330	4,769	129,694	22,796	214	931	158,404	70
	5	30,420	11	94,911	435,205	1,148	436,353	0	k 2,369	64,074	56,275	313,635	1,831	37,325	41,754	220,848	3,117	8,760	0	2,395	41,128	7,082	449	69	51,123	71
	T 2	T 111,500	0	0	413,407	396	413,803	0	2,012	36,762	20,474	354,555	8,116	68,804	(d)	d 210,871	8,602	25,994	32,168	a 5,220	a 71,845	(d)	a,d 11,602	a 671	a 89,338	72
	3	89,000	0	0	304,985	48	305,033	0	2,199	40,474	18,510	243,850	4,729	48,254	49,171	131,790	2,838	695	6,373	4,201	58,684	8,231	822	770	72,708	73
	1	66,500	4	26,720	270,506	—2,269	268,237	0	1,083	53,294	72,574	141,286	2,150	13,498	17,213	106,223	2,202	0	0	2,267	21,918	5,224	778	47	30,234	74
	2	107,000	1	400	244,459	0	244,459	0	1,507	34,272	22,935	186,195	3,425	46,117	33,325	88,708	6,167	0	8,453	2,963	52,435	8,681	172	458	64,709	75
System	22	87,946	4	2,051	234,641	7,386	242,027	0	5,068	35,413	17,402	184,144	5,230	46,900	d 111,610	(d)	6,808	4,592	9,004	6,937	66,496	d 16,985	(d)	366	90,784	76
	10	58,803	2	1,460	202,923	1,096	204,019	3,375	2,256	22,307	37,753	138,328	4,792	32,371	24,155	74,138	2,872	0	0	4,658	41,241	9,619	291	93	55,902	77
	16	66,654	13	7,265	170,103	33,257	203,360	0	1,630	37,729	27,831	136,170	5,077	44,504	50,886	22,946	5,728	498	6,531	4,372	60,913	18,150	55	465	83,955	78
ilities	1	69,000	0	0	155,988	0	155,988	0	o 16,299	14,838	0	124,851	.....	28,034	18,625	74,275	3,203	714	0	.....	29,609	4,042	62	1	33,714	79
	39	45,100	17	2,235	127,312	28,452	155,764	0	2,839	20,889	14,367	117,669	3,217	35,581	38,960	31,733	2,914	999	4,265	3,144	48,064	11,769	59	310	63,346	80
	3	46,500	0	0	155,022	63	155,085	0	45	20,887	0	134,153	0	28,206	15,101	90,241	0	0	605	0	30,342	3,880	1,204	0	35,426	81
	5	25,107	0	0	66,457	51,949	118,406	315	0	21,278	7,612	89,201	7,031	27,283	24,604	27,616	2,667	0	0	3,391	41,794	10,004	351	111	55,651	82
	7	37,978	5	4,930	104,248	62	104,310	.....	294	24,232	16,420	63,364	800	27,808	25,958	5,580	3,218	0	0	711	29,240	10,505	15	317	40,788	83
	160	1,908,179	84	506,307	7,498,322	221,206	7,719,528	4,643	67,888	1,041,579	836,141	5,769,277	63,681	1,283,671	1,080,617	2,848,427	130,055	251,546	111,280	53,682	1,362,719	226,055	37,904	5,013	1,685,373	
	.....	.....	.....	.....	g 2,363,375	395,872	O 2,759,247	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	84
	19	94,439	22	287,500	1,361,023	689,336	2,050,359	50,675	11,599	338,420	x 155,692	1,493,973	.....	250,721	258,457	965,509	18,198	1,088	0	.....	179,331	39,252	497	328	219,408	85
altimore	4	250,950	0	0	701,979	944,058	1,646,037	0	2,778	x 150,221	x 9,705	1,483,333	(f)	f 203,742	243,096	722,580	15,388	279,942	18,585	(f)	f 247,907	40,815	225	27	288,974	86
	2	255,000	0	0	1,103,820	—110,681	993,139	0	6,723	112,716	15,284	858,416	(f)	f 200,491	220,714	326,903	26,225	84,083	0	(f)	f 169,818	27,051	322	39	197,230	87
	2	43,000	10	206,050	684,979	238,302	923,281	0	2,303	192,988	131,600	596,390	13,141	97,364	d 456,672	(d)	6,082	0	23,131	14,345	76,324	d 19,655	(d)	1,826	112,150	88
	2	141,000	7	30,535	754,857	19,425	774,282	33,133	k 7,786	85,508	27,945	619,910	(f)	f 152,011	154,789	285,528	4,138	352	23,092	(f)	f 133,738	23,834	787	1,003	159,362	89
	37	139,028	0	0	417,099	1,846	418,945	0	13,272	80,517	177	324,979	8,011	123,349	122,435	38,299	29,348	3,537	0	1,846	110,805	26,715	834	1,608	141,808	90
	8	83,402	10	15,106	347,382	9,343	356,725	4,010	8,340	56,325	13,126	274,924	9,480	76,271	49,658	102,461	4,759	5	32,290	6,388	82,746	14,204	515	617	104,470	91
	1	n 72,500	2	24,630	289,922	43,642	333,564	0	5,187	33,393	148,200	146,784	2,110	15,934	20,085	104,585	1,420	0	2,650	1,749	16,487	4,862	237	111	23,446	92
	0	0	1	130,000	237,285	52,507	289,792	0	8	3,558	286,226	0	0	0	0	0	0	0	0	0	0	0	0	0	0	93
	5	44,631	3	14,193	192,917	33,488	226,405	0	2,053	47,419	102,649	74,284	1,954	30,144	22,390	16,106	751	0	2,939	1,289	31,372	6,745	204	346	39,956	94
	1	T 22,500	0	0	205	220,502	220,707	0	1,360	16,477	12,129	190,741	(f)	f 33,148	y 42,961	x 100,234	2,816	11,096	146	(f)	f 34,797	y 6,582	z 196	24	41,599	95
	2	42,500	0	0	187,584	0	187,584	8,258	3,732	25,492	819	149,283	1,990	26,919	23,386	92,147	2,457	0	2,384	1,634	36,314	6,753	70	317	45,088	96
	4	19,570	1	23,600	136,866	44,914	b 181,780	0	1,104	22,898	26,311	131,467	.....	32,384	24,241	72,756	2,086	0	0	.....	23,882	6,466	103	43	30,494	97
	1	81,500	0	0	159,286	0	159,286	0	0	19,641	3,753	135,892	.....	42,168	40,221	43,972	7,963	0	1,568	.....	34,685	7,301	134	914	43,034	98
	3	28,228	0	0	88,950	12,427	101,377	0	7,230	18,324	5,719	70,104	2,913	14,621	7,923	41,643	965	0	2,039	1,081	13,300	2,877	163	384	17,805	99
	g 91	g 1,318,248	g 56	g 731,614	g 6,664,154	g 2,199,109	g 8,863,263	96,076	73,475	1,203,897	939,335	6,550,480	39,599	1,299,267	1,687,028	2,912,723	122,596	380,103	109,164	28,332	1,191,506	233,112	4,287	7,587	1,464,824	
	23	227,655	19	610,709	2,748,769	8,197	2,756,966	0	178,132	207,148	r 1,381,183	990,503	1,670	12,376	6,374	969,592	245	0	246	1,982	7,004	1,929	19	15	10,949	100
onsol. Rep't)	0	0	0	0	0	944,123	944,123	0	0	139,460	0	804,663	24,401	182,696	146,693	403,035	11,829	0	36,009	40,466	255,586	57,480	814	443	354,789	101
d Subs	12	165,379	6	414,500	2,425,857	170,971	2,596,828	986	5,630	321,782	1,127,055	1,141,375	.....	152,505	121,652	859,546	7,672	0	0	.....	123,597	26,646	619	268	151,130	102
	2	129,500	1	80,320	428,199	49,466	477,665	0	5,085	48,347	77,990	346,243	.....	72,538	y 56,858	z 151,189	8,550	33,799	k 23,309	.....	86,920	y 11,290	z 3,539	599	102,348	103
p)	10	72,700	2	30,540	342,618	95,341	437,959	0	7,962	65,046	65,827	299,124	7,416	53,157	54,710	164,615	5,950	0	13,276	6,174	72,347	15,488	1,432	1,243	96,684	104
	1	11,300	0	0	(m)	332,958	332,958	31,831	1,960	36,049	0	263,118	.....	56,481	64,510	137,302	2,972	0	k 1,853	.....	68,096	8,776	199	282	77,353	105
	25	15,170	0	0	14,587	224,541	239,128	0	1,251	37,193	13,577	187,107	3,753	33,044	58,881	91,429	0	0	0	1,720	43,080	11,553	1,315	0	57,668	106
	10	17,490	0	0	18,137	178,372	196,509	0	1,004	33,260	3,826	158,419	.....	31,805	42,853	80,534	3,190	37	0	.....	28,740	7,686	85	82	36,593	107
	83	639,194	28	1,136,069	5,978,167	2,003,969	7,982,136	32,817	201,024	888,285	2,669,458	4,190,552	37,240	594,602	552,531	2,857,242	40,408	33,836	74,693	50,342	685,370	140,848	8,022	2,932	887,514	
	11	86,868	0	0	642,245	103,057	745,302	0	2,812	53,783	426,539	262,168	4,117	20,257	16,610	213,579	7,605	0	0	3,804	33,519	7,007	450	671	45,451	108
	4	206,586	0	0	719,041	21,234	740,275	0	3,407	79,435	24,369	633,064	2,193	103,238	173,859	299,141	4,715	11,022	38,896	a 1,171	a 119,439	a 17,430	a 743	a 865	a 139,648	109
	8	181,516	0	0	722,719	1,945	724,664	0	8,625	k 67,311	18,362	630,366	w 203	69,211	64,438	488,033	2,393	0	6,088	w 30	71,259	13,862	492	99	85,742	110
	14	T 170,176	0	0	629,524	22,935	652,459	0	k 6,175	96,090	10,117	540,077	w 19,168	90,120	98,025	288,503	8,058	12,094	24,109	w 9,800	119,960	24,601	7,416	1,800	163,577	111
	9	96,940	0	0	587,980	50,067	638,047	0	(v)	v 122,308	91,683	424,056	8,974	70,442	74,582	218,938	l 34,788	16,332	0	10,562	99,044	20,809	2,854	l 1,996	135,265	112
	17	42,030	3	65,968	162,599	334,110	496,709	0	7,331	80,208	61,408	347,762	3,650	43,465	52,636	226,563	l 16,451	4,997	0	4,807	60,330	17,088	768	l 1,535	84,528	113
	11	98,126	0	0	475,521	3,900	479,421	0	(v)	v 87,952	17,725	373,744	2,787	60,208	89,918	184,897	30,629	5,305	0	2,526	77,301	13,250	1,304	873	95,254	114
	1	138,000	0	0	470,042	0	470,042	34,938	4,383	38,969	91,676	300,076	.....	58,752	99,146	111,898	12,176	0	18,104	.....	93,925	14,729	1,396	573	110,623	115
	2	113,750	0	0	344,249	—22	344,227	0	3,637	36,566	0	304,024	390	71,342	130,437	42,150	7,469	27,557	24,679	238	76,583	9,090	927	408	87,246	116
	28	61,503	5	15,000	287,352	33,553	320,905	0	25,524	61,890	17,634	215,857	7,626	43,779	62,964	90,514	2,440	0	8,534	5,297	51,475	18,543	1,095	314	76,724	117
	9	55,515	0	0	255,263	56,646	311,909	0	6,707	41,406	16,496	247,300	.....	51,006	88,772	86,865	3,923	8,565	8,169	.....	62,625	14,824	84	1,056	78,589	118
	11	99,241	0	0	256,676	35,011	291,687	0	2,603	38,056	25,161	225,867	1,795	49,582	27,998	136,967	2,959	705	5,861	1,255	60,098	10,993	1,975	543	74,864	119
	16	52,442	0	0	267,994	6,479	274,473	0	9,618	44,345	77,768	142,742	1,101	37,335	32,545	62,767	1,888	22	7,084	689	38,079	11,302	956	855	51,881	120
	10	98,300	3	1,100	233,108	27,303	260,411	0	2,073	33,529	15,742	209,067	3,235	44,890	82,533	52,503	2,232	0	23,674	1,896	64,283	11,479	204	266	78,128	121
	4	56,529	0	0	142,932	357	143,289	4,372	1,244	16,367	10,785	110,521	2,445	21,024	y 23,082	z 51,765	1,165	0	11,040	1,493	19,949	y 3,354	z 123	121	25,040	122
	3	30,000	0	0	107,582	28	107,610	0	305	8,848	2,575	95,882	265	1,765	2,449	90,423	35	.....	945	180	2,718	954	41	219	4,112	123
	158	1,587,522	11	82,068	6,304,827	696,603	7,001,430	39,310	84,444	907,063	908,040	5,062,573	57,949	836,416	1,119,994	2,645,506	138,926	86,599	177,183	43,748	1,050,587	209,315	20,828	12,194	1,336,672	
	0	0	1	704,800	2,507,932	0	2,507,932	0	15,353	22,519	2,464,353	5,707	0	2,738	1,605	.....	.....	.....	1,364	0	575	72	.....	2	649	124
	0	0	12	342,000	1,525,301	—33,505	1,491,796	0	(p)	v 175,493	14,218	1,302,085	3,801	59,915	55,378	875,848	8,593	91,072	207,478	2,847	70,426	10,946	1,114	1,300	86,633	125
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	d 626,156	(d)	7,720	20,340	6,095	16,002	82,571	d 12,179	(d)	265	111,017	126

h Transferred to affiliated transportation co.

j Includes water heater service (off-peak).

k Lines 20, 24, 71, 89, 111, 126, 132, 136, 142, 146 — Incl. free service (franchise requirements, etc.). Lines 32, 35, 41, 49, 103, 105 — Other public authorities. (110) Includes 71 free service.

l Lines 9, 28 — Misc. municipal. (112, 113) All govt. and munic. uses.

m Incl. companies' share of: Line 32 — Deepwater plant (35) Stanton; (41) Ohio Power share of Windsor and 30,000 kw. allocated to West Penn Pwr. (105) 1,282 generated for Alabama Pwr. and purchased from same at regular contract rate.

n Line 46 — Incl. 57,900 reduced to 28,000 in steam heating season by boiler requirements. (92) Limited by boiler capacity to 66,000.

o Line 43 — Sales to munic. for genl. lt. and pwr. (60) to San. Distr. Oper. Div. Sewage and Pumping. (79) 16,003 used by water dept.

p All sales to other utilities via Bonneville Power Administration.

r Lines 44, 47, 56 — Interdepartmental.

t Line 100 — Incl. sales to munic. and coops., line (101). Lines 140, 161 — Incl. in sales.

u Line 1 — Incl. 2 combination plants. (22) Incl. 4 hydro plants which are also fuel-burning. (23) One of these, 5,000 kw., oper. on purchased steam. (46) One combination plant; total, 20.

v Company use and losses combined.

w Line 20 — Incl. only rural customers or farm service riders or other special contract. (31,) 110) Special agricultural or rural rate. (111, 137) Rural. (128) Rural domestic, commercial, power (131) Agr. pwr. irrig. (143) Distinct rural rates only.

x Line 86 — Col. 12, incl. 14,070 frequency changer oper. Col. 13, incl. "firm peak" service to Pot. El. Pwr. (150) San Joaquin Lt. & Pwr. at transformers.

y Commercial.

z Industrial or power.

A Estimated figures.

B Output of leased plants.

Texas Power & Light Co.	9	96,940	0	0	587,980	50,067	638,047	0	(v)	v 122,308	91,683	424,056	8,974	70,442	74,582	218,938	l 34,788	16,332	0	10,562	99,044	20,809	2,854	l 1,996	135,265	112
Arkansas Power & Light Co.	17	42,030	3	65,968	162,599	334,110	496,709	0	7,331	80,208	61,408	347,762	3,650	43,465	52,636	226,563	l 16,451	4,997	0	4,807	60,330	17,088	768	l 1,535	84,528	113
Texas Electric Service Co.	11	98,126	0	0	475,521	3,900	479,421	0	(v)	v 87,952	17,725	373,744	2,787	60,208	89,918	184,897	30,629	5,305	0	2,526	77,301	13,250	1,304	873	95,254	114
New Orleans Public Service, Inc.	1	138,000	0	0	470,042	0	470,042	34,938	4,383	38,969	91,676	300,076	.....	58,752	99,146	111,898	12,176	0	18,104	.....	93,925	14,729	1,396	573	110,623	115
Dallas Power & Light Co.	2	113,750	0	0	344,249	—22	344,227	0	3,637	36,566	0	304,024	390	71,342	130,437	42,150	7,469	27,557	24,679	238	76,583	9,090	927	408	87,246	116
Central Power and Light Co.	28	61,503	5	15,000	287,352	33,553	320,905	0	25,524	61,890	17,634	215,857	7,626	43,779	62,964	90,514	2,440	0	8,534	5,297	51,475	18,543	1,095	314	76,724	117
Southwestern Gas & Electric Co.	9	55,515	0	0	255,263	56,646	311,909	0	6,707	41,406	16,496	247,300	.....	51,006	88,772	86,865	3,923	8,565	8,169	.....	62,625	14,824	84	1,056	78,589	118
Public Service Co. of Okla.	11	99,241	0	0	256,676	35,011	291,687	0	2,603	38,056	25,161	225,867	1,795	49,582	27,998	136,967	2,959	705	5,861	1,255	60,098	10,993	1,975	543	74,864	119
West Texas Utilities Co.	16	52,442	0	0	267,994	6,479	274,473	0	9,618	44,345	77,768	142,742	1,101	37,335	32,545	62,767	1,888	22	7,084	689	38,079	11,302	956	855	51,881	120
San Antonio Public Service Co.	10	98,300	3	1,100	233,108	27,303	260,411	0	2,073	33,529	15,742	209,067	3,235	44,890	82,533	52,503	2,232	0	23,674	1,896	64,283	11,479	204	266	78,128	121
El Paso Electric Co.	4	56,529	0	0	142,932	357	143,289	4,372	1,244	16,367	10,785	110,521	2,445	21,024	y 23,082	z 51,765	1,165	0	11,040	1,493	19,949	y 3,354	z 123	121	25,040	122
Panhandle Power & Light Co.	3	30,000	0	0	107,582	28	107,610	0	305	8,848	2,575	95,882	265	1,765	2,449	90,423	35	.....	945	180	2,718	954	41	219	4,112	123
Totals for section	158	1,587,522	11	82,068	6,304,827	696,603	7,001,430	39,310	84,444	907,063	908,040	5,062,573	57,949	836,416	1,119,994	2,645,506	138,926	86,599	177,183	43,748	1,050,587	209,315	20,828	12,194	1,336,672	
Rocky Mountain States																										
Bureau of Reclamation (Boulder Dam)	0	0	1	704,800	2,507,932	0	2,507,932	0	15,353	22,519	2,464,353	5,707	0	2,738	1,605	.....	.....	.....	1,364	0	575	72	.....	2	649	124
The Montana Power Co.	0	0	12	342,000	1,525,301	—33,505	1,491,796	0	(v)	v 175,493	14,218	1,302,085	3,801	59,915	55,378	875,848	8,593	91,072	207,478	2,847	70,426	10,946	1,114	1,300	86,633	125
Utah Power & Light Co.	6	61,985	29	178,192	506,098	434,400	940,498	0	k 6,608	154,267	9,763	769,860	16,217	93,332	d 626,156	(d)	7,720	20,340	6,095	16,002	82,571	d 12,179	(d)	265	111,017	126
Idaho Power Co.	2	535	13	101,875	732,092	34,457	766,549	0	4,681	89,057	443,590	229,221	26,875	67,708	59,122	72,623	2,893	0	0	a 14,431	a 38,475	a 10,488	a 175	a 52	a 63,621	127
Public Service Co. of Colorado	12	114,507	10	42,975	492,067	7,607	499,674	0	4,941	71,142	49,281	374,310	w 7,627	72,997	78,106	207,198	8,382	0	0	w 5,208	106,235	18,346	6,648	77	136,514	128
Salt River Valley Water Users' Assn.	1	10,000	8	70,950	251,147	111,362	362,509	0	52,460	62,415	37,073	210,561	86,517	13,685	.....	109,235	.....	.....	1,124	291	6,338	.....	57	3	6,689	129
Central Arizona Light and Power Co.	2	28,000	0	0	169,154	—33,296	135,858	0	0	19,178	0	116,680	4,948	24,270	22,481	54,435	2,140	2,003	6,403	874	24,839	3,864	109	170	29,856	130
Totals for section	23	215,027	73	1,440,792	6,183,791	521,025	6,704,816	0	84,043	594,071	3,018,278	3,008,424	145,985	334,645	842,848	1,319,339	29,728	113,415	222,464	39,653	329,459	55,895	8,103	1,869	434,979	
Pacific States																										
Pacific Gas and Electric Co.	10	424,175	49	876,794	4,266,537	1,461,867	5,728,404	3,482	71,356	1,243,998	258,714	4,150,854	w 673,337	690,197	1,831,552	650,915	63,995	233,283	7,575	w 36,681	699,420	156,997	4,091	570	897,759	131
Southern California Edison Co., Ltd.	L 4	L 439,250	L 24	L 656,920	3,597,011	21,188	3,618,199	0	7,192	k 647,737	519,077	2,444,193	424,027	348,326	232,952	1,054,290	42,797	243,261	98,540	42,317	406,884	59,383	23,844	4,931	537,359	132
City of Los Angeles, Dept. of Water & Power	3	187,500	6	374,605	1,650,969	40,075	1,691,044	0	11,405	261,056	13,936	1,404,647	.....	332,133	734,018	261,030	64,016	0	13,450	.....	a369,030	a 87,883	a 2,443	a 965	a460,321	133
Puget Sound Power & Light Co.	3	104,500	12	210,685	1,138,571	16,468	1,155,039	0	13,994	254,910	29,907	856,228	(f)	f 236,221	228,218	323,653	5,427	43,154	19,555	(f)	f 172,209	23,125	640	256	196,230	134
The Washington Water Power Co.	0	0	12	203,534	983,096	50,323	1,033,419	0	15,824	142,309	118,313	756,973	19,815	126,340	99,586	427,821	6,506	37,636	39,269	6,194	62,638	10,390	607	91	79,920	135
Portland General Electric Co.	3	90,000	7	93,465	588,794	155,751	744,545	0	k 2,327	129,486	1,332	611,400	18,845	145,540	94,903	266,693	13,249	50,031	22,139	15,277	105,055	14,809	207	1,163	136,511	136
The California Oregon Power Co.	1	15,000	12	100,080	581,405	18,879	600,284	0	3,920	85,978	351,655	158,731	w 14,185	54,942	28,106	59,391	1,566	0	541	w 3,165	25,260	6,598	105	80	35,208	137
Northwestern Electric Co.	2	42,500	1	9,600	188,052	360,709	548,761	0	1,133	65,203	159,052	323,373	3,635	50,828	55,446	207,958	5,506	0	0	4,478	36,307	5,696	572	207	47,260	138
Hetch Hetchy Water Supply (San Francisco)	0	0	2	83,000	525,993	0	525,993	0	1,238	32,273	492,482	0	0	0	0	0	0	0	0	0	0	0	0	0	0	139
City of Seattle — Department of Lighting	1	30,000	4	209,000	469,700	1	469,701	(t)	(t)	87,139	15,956	366,606	0	119,978	82,378	113,802	19,833	30,615	0	0	83,920	9,319	3,211	447	96,897	140
City of Tacoma, Dept. of Public Utilities	2	34,000	3	114,000	417,408	0	417,408	0	1,343	65,073	9,701	341,291	.....	63,980	37,348	219,904	7,198	469	12,392	.....	32,626	3,865	1,003	297	37,791	141
The Nevada-Calif. Electric Corp.	2	8,135	9	50,875	216,555	200,366	416,921	k 195	7,925	95,740	44,305	268,756	44,255	34,803	d 140,511	(d)	907	48,280	0	1,459	28,093	d 6,334	(d)	60	35,946	142
Pacific Power & Light Co.	1	10,000	9	21,817	158,175	125,126	283,301	0	4,470	59,019	6,003	213,809	w 13,634	74,401	66,120	52,025	3,272	1,662	2,695	w 15,666	49,940	13,819	151	192	79,768	143
San Diego Consolidated Gas & Elec. Co.	1	99,000	0	0	247,690	16,337	264,027	0	3,643	38,676	1,601	220,107	42,552	50,918	55,579	43,070	6,439	14,780	6,769	15,606	65,380	14,141	147	121	95,395	144
Inland Power & Light Co.	0	0	2	45,800	240,845	9	240,854	0	0	240	240,614	0	0	0	0	0	0	0	0	0	0	0	0	0	0	145
Mountain States Power Co.	45	16,235	13	6,306	58,769	127,074	185,843	0	k 2,843	29,327	4,775	148,898	440	61,078	22,636	61,459	2,887	0	398	254	49,212	8,736	2,592	112	60,906	146
Turlock-Modesto Irrigation Districts	1	1,000	2	34,000	177,957	2,120	180,077	0	15,364	15,169	77,671	71,873	(P)	(P)	(P)	(P)	(P)	(P)	P 71,873	(P)	(P)	(P)	(P)	P 18,092	18,092	147
Engineer Dept., U. S. Army (Bonneville)	0	0	1	86,400	151,770	0	151,770	0	6,530	656	p 144,584	0	0	0	0	0	0	0	0	0	0	0	0	0	0	148
Washington Gas and Electric Co.	1	27,000	1	125	136,258	4,687	140,945	0	1,378	6,524	151	132,892	112	4,896	2,997	124,216	273	0	398	80	4,591	458	134	3	5,266	149
Merced Irrigation District	0	0	1	X 31,250	112,693	0	112,693	0	0	0	x 112,693	0	0	0	0	0	0	0	0	0	0	0	0	0	0	150
Totals for section	80	1,528,295	170	3,208,256	15,908,248	2,600,980	18,509,228	3,677	171,885	3,260,513	2,602,522	12,470,631	1,254,837	2,394,581	3,712,350	3,866,227	243,871	703,171	295,594	141,177	2,190,565	421,553	39,747	27,587	2,820,629	
Canada																										
Hydro-Electric Power Commission of Ontario (g)	1	20,000	45	1,140,000	g5,910,279	g2,763,004	g8,673,283	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	151
Shawinigan Water & Power Co. and Subs.	0	0	18	701,372	4,700,149	1,223,739	5,923,888	0	23,856	405,984	689,156	4,804,892	4,941	70,154	105,288	2,560,323	7,461	18,363	Q2,038,362	16,617	90,198	23,511	382	384	131,092	152
Montreal Light, Heat & Power Consol. and Subs.	1	20,000	5	548,720	2,348,851	951,586	3,300,437	0	0	146,142	1,062,253	2,092,042	(f)	f 146,609	175,927	1,623,420	16,520	129,566	0	(f)	a,f223,572	a 36,678	a 7,364	a 22	a267,636	153
Gatineau Power Co.	1	6,750	17	534,608	3,005,914	2,885	3,008,799	0	0	51,437	1,411,634	1,545,728	957	11,955	8,908	1,516,144	1,342	3,620	2,802	2,714	17,949	4,150	37	341	25,191	154
Saguenay Power Co., Ltd.	0	0	1	420,000	2,362,812	115,508	2,478,320	0	0	15,283	832,703	1,630,334	.....	.....	.....	1,630,334	.....	.....	.....	.....	.....	.....	4	.....	4	155
Aluminum Power Co., Ltd.	0	0	1	200,000	1,479,644	0	1,479,644	0	0	53,144	84,301	1,342,199	.....	223	19	1,341,957	.....	.....	.....	.....	13	1	5	.....	19	156
West Kootenay Power & Light Co., Ltd.	0	0	5	167,700	1,235,333	57	1,235,390	0	1,074	106,896	8,414	1,119,006	1,800	5,317	3,958	1,107,363	568	0	0	667	5,627	1,187	26	5	7,512	157
Winnipeg Electric Co.	1	X 12,000	3	X251,100	830,659	0	830,659	0	0	86,594	34,019	710,046	0	104,076	45,270	217,378	1,653	34,953	306,716	0	24,362	5,146	1,524	29	31,061	158
Canada Northern Power Corp., Ltd.	0	0	9	94,375	475,132	274,772	749,904	0	8,760	57,236	0	683,908	.....	30,165	22,244	630,036	1,463	0	0	.....	20,898	4,243	57	18	25,216	159
Canadian Niagara Power Co., Ltd. (g)	0	0	1	75,000	g 611,083	0	g 611,083	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	160
City of Winnipeg Hydro-Electric System	1	11,000	2	115,820	590,672	0	590,672	0	(t)	87,573	579	502,574	0	201,019	27,915	100,244	14,866	0	U158,476	0	41,352	2,463	3,575	6	47,396	161
British Columbia Elec. Railway Co., Ltd (Y)	1	X 17,500	5	X211,325	504,689	0	504,689	83,149	9,840	36,521	8,605	366,574	.....	95,891	77,135	181,498	12,050	0	0	.....	93,735	16,154	3,165	16	113,070	162
Churchill River Power Co., Ltd.	0	0	1	74,900	349,027	0	349,027	0	0	14,845	0	334,182	.....	.....	2,790	.....	.....	.....	331,392	.....	.....	1	.....	2	3	163
Great Lakes Power Co., Ltd.	0	0	4	54,200	256,234	0	256,234	1,040	.....	10,342	20,872	223,980	58	246	212	223,423	41	0	0	116	419	137	18	4	694	164
Southern Canada Power Co., Ltd.	0	0	5	43,865	215,244	35,631	250,875	0	1,232	39,871	70,910	138,862	923	18,939	10,267	84,110	3,466	0	Q 21,157	1,596	22,466	4,542	557	118	29,279	165
The Nova Scotia Power Commission	.....	Z 318	.....	Z 75,850	244,128	272	244,400	0	0	11,883	45,061	187,456	(f)	(f)	f 1,192	186,195	69	0	0	(f)	(f)	f 3,511	11	16	3,538	166
Montreal Island Power Co.	0	0	1	45,000	238,094	0	238,094	0	0	0	238,094	0	0	0	0	0	0	0	0	0	0	0	0	0	0	167
The Ottawa Electric Co.	1	X 4,000	2	X 12,200	95,858	109,167	205,025	0	.....	.....	464	204,561	(f)	f 80,946	(d)	d 86,066	616	12,136	24,797	(f)	f 24,367	(d)	d 4,753	251	29,371	168
Calgary Power Co., Ltd.	5	13,077	3	53,000	143,205	1,960	145,165	0	646	17,844	91,751	34,924	375	4,726	9,102	19,521	1,200	0	0	327	9,291	5,414	22	101	15,155	169
Totals for Canada (g)	12	104,645	128	4,819,035	g19,075,645	g2,715,577	g21,791,222	84,189	45,408	1,141,595	4,598,816	15,921,214	9,054	770,266	490,227	11,508,012	61,315	198,638	2,883,702	22,037	574,249	107,138	21,500	1,313	726,237	
Mexico																										
The Mexican Lt. & Pwr. Co., Ltd. and Subs.	2	31,000	15	207,000	1,083,184	10,385	1,093,569	0	21,165	361,245	0	711,159	1,435	91,183	44,125	3,548	12,337	74,798	483,733	132	201,326	54,092	42	8,644	264,236	170
Electric Railways and Electrified Railroads																										
The Pennsylvania Railroad	0	0	0	0	0	G 1,148,804	G 1,148,804																			171
Interborough Rapid Transit Co.	2	390,000	0	0	1,061,095	95	1,061,190																			172
Williamsburgh Power Plant Corp.	1	220,000	0	0	657,226	0	657,226																			173
Chicago Surface Lines	0	0	0	0	0	589,565	589,565																			174
Board of Transportation, N. Y. City Subway	0	0	0	0	0	454,048	454,048																			175
Philadelphia Rapid Transit Co.	0	0	0	0	0	314,867	314,867																			176
The New York Central Railroad Co.	0	0	0	0	0	243,466	243,466																			177
Boston Elevated Railway	2	180,000	0	0	221,873	3,749	225,622																			178
New York, New Haven & Hartford R. R. Co.	1	43,000	0	0	91,973	79,407	171,380																			179
Norfolk & Western Railway Co.	5	42,955	0	0	95,098	36,875	131,973																			180
Pacific Electric Railway Co.	0	0	0	0	0	124,985	124,985																			181
St. Louis Public Service Co.	0	0	0	0	0	123,507	123,507																			182
Twin City Rapid Transit Co.	1	74,000	L 2	L 16,000	70,016	B 45,488	115,504																			183
Chicago, Milwaukee, St. Paul & Pacific R. R. Co.	0	0	0	0	0	105,631	105,631																			184
Totals for railways and railroads	12	949,955	2	16,000	2,197,281	3,270,487	5,467,768																			

SUMMARY OF GENERATOR RATING AND OUTPUT OF LARGE UTILITY SYSTEMS

Region	No. Cos. of System	Number of Generating Plants and Generator Rating — All Plants — No.	All Plants — Rating, Kw.	Fuel Plants — No.	Fuel Plants — Rating, Kw.	Hydro Plants — No.	Hydro Plants — Rating, Kw.	Energy Generated (Net) Thous. Kw.-Hr.	Rec'd by Purch. or Interchange Thous. Kw.-Hr.	Output Gen. and Purch. Thous. Kw.-Hr.
United States (g)	150	1,796	34,382,006	916	24,184,617	880	10,197,389	116,724,505	14,845,051	131,569,556
New England	17	176	2,483,765	46	1,719,477	130	764,288	7,539,818	1,526,111	9,065,929
Middle Atlantic	22	291	9,300,813	127	7,552,610	164	1,748,203	32,160,419	3,042,608	35,203,027
East North Central	28	312	8,295,857	148	7,716,065	164	579,792	28,486,759	2,033,440	30,520,199
West North Central	16	244	2,414,486	160	1,908,179	84	506,307	7,498,322	221,206	7,719,528
South Atlantic (g)	16	147	2,049,862	91	1,318,248	56	731,614	6,664,154	2,199,109	8,863,263
East South Central	8	111	1,775,263	83	639,194	28	1,136,069	5,978,167	2,003,969	7,982,136
West South Central	16	169	1,669,590	158	1,587,522	11	82,068	6,304,827	696,603	7,001,430
Mountain	7	96	1,655,819	23	215,027	73	1,440,792	6,183,791	521,025	6,704,816
Pacific	20	250	4,736,551	80	1,528,295	170	3,208,256	15,908,248	2,600,980	18,509,228
Canada (g)	19	140	4,923,680	12	104,645	128	4,819,035	19,075,645	2,715,577	21,791,222
Mexico	1	17	238,000	2	31,000	15	207,000	1,083,184	10,385	1,093,569
Railways and Railroads	14	14	965,955	12	949,955	2	16,000	2,197,281	3,270,487	5,467,768

	14	T 170,176	0	0	629,524	22,935	652,459	0	k 6,175	96,090	10,117	540,077	w 19,168	90,120	98,025	288,503	8,058	12,094	24,109	w 9,800	119,900	24,001	7,410	1,800	165,377	111
	9	96,940	0	0	587,980	50,067	638,047	0	(v)	v 122,308	91,683	424,056	8,974	70,442	74,582	218,938	l 34,788	16,332	0	10,562	99,044	20,809	2,854	l 1,996	135,265	112
	17	42,030	3	65,968	162,599	334,110	496,709	0	7,331	80,208	61,408	347,762	3,650	43,465	52,636	226,563	l 16,451	4,997	0	4,807	60,330	17,088	768	l 1,535	84,528	113
	11	98,126	0	0	475,521	3,900	479,421	0	(v)	v 87,952	17,725	373,744	2,787	60,208	89,918	184,897	30,629	5,305	0	2,526	77,301	13,250	1,304	873	95,254	114
	1	138,000	0	0	470,042	0	470,042	34,938	4,383	38,969	91,676	300,076	.....	58,752	99,146	111,898	12,176	0	18,104	.....	93,925	14,729	1,396	573	110,623	115
	2	113,750	0	0	344,249	—22	344,227	0	3,637	36,566	0	304,024	390	71,342	130,437	42,150	7,469	27,557	24,679	238	76,583	9,090	927	408	87,246	116
	28	61,503	5	15,000	287,352	33,553	320,905	0	25,524	61,890	17,634	215,857	7,626	43,779	62,964	90,514	2,440	0	8,534	5,297	51,475	18,543	1,095	314	76,724	117
	9	55,515	0	0	255,263	56,646	311,909	0	6,707	41,406	16,496	247,300	.....	51,006	88,772	86,865	3,923	8,565	8,169	.....	62,625	14,824	84	1,056	78,589	118
	11	99,241	0	0	256,676	35,011	291,687	0	2,603	38,056	25,161	225,867	1,795	49,582	27,998	136,967	2,959	705	5,861	1,255	60,098	10,993	1,975	543	74,864	119
	16	52,442	0	0	267,994	6,479	274,473	0	9,618	44,345	77,768	142,742	1,101	37,335	32,545	62,767	1,888	22	7,084	689	38,079	11,302	956	855	51,881	120
	10	98,300	3	1,100	233,108	27,303	260,411	0	2,073	33,529	15,742	209,067	3,235	44,890	82,533	52,503	2,232	0	23,674	1,896	64,283	11,479	204	266	78,128	121
	4	56,529	0	0	142,932	357	143,289	4,372	1,244	16,367	10,785	110,521	2,445	21,024	y 23,082	z 51,765	1,165	0	11,040	1,493	19,949	y 3,354	z 123	121	25,040	122
	3	30,000	0	0	107,582	28	107,610	0	305	8,848	2,575	95,882	265	1,765	2,449	90,423	35	.....	945	180	2,718	954	41	219	4,112	123
	158	1,587,522	11	82,068	6,304,827	696,603	7,001,430	39,310	84,444	907,063	908,040	5,062,573	57,949	836,416	1,119,994	2,645,506	138,926	86,599	177,183	43,748	1,050,587	209,315	20,828	12,194	1,336,672	
	0	0	1	704,800	2,507,932	0	2,507,932	0	15,353	22,519	2,464,353	5,707	0	2,738	1,605	.....	.....	.....	1,364	0	575	72	.....	2	649	124
	0	0	12	342,000	1,525,301	—33,505	1,491,796	0	(p)	v 175,493	14,218	1,302,085	3,801	59,915	55,378	875,848	8,593	91,072	207,478	2,847	70,426	10,946	1,114	1,300	86,633	125
	6	61,985	29	178,192	506,098	434,400	940,498	0	k 6,608	154,267	9,763	769,860	16,217	93,332	d 626,156	(d)	7,720	20,340	6,095	16,002	82,571	d 12,179	(d)	265	111,017	126
	2	535	13	101,875	732,092	34,457	766,549	0	4,681	89,057	443,590	229,221	26,875	67,708	59,122	72,623	2,893	0	0	a 14,431	a 38,475	a 10,488	a 175	a 52	a 63,621	127
	12	114,507	10	42,975	492,067	7,607	499,674	0	4,941	71,142	49,281	374,310	w 7,627	72,997	78,106	207,198	8,382	0	0	w 5,208	106,235	18,346	6,648	77	136,514	128
	1	10,000	8	70,950	251,147	111,362	362,509	0	52,460	62,415	37,073	210,561	86,517	13,685	.....	109,235	.....	.....	1,124	291	6,338	.....	57	3	6,689	129
	2	28,000	0	0	169,154	—33,296	135,858	0	0	19,178	0	116,680	4,948	24,270	22,481	54,435	2,140	2,003	6,403	874	24,839	3,864	109	170	29,856	130
	23	215,027	73	1,440,792	6,183,791	521,025	6,704,816	0	84,043	594,071	3,018,278	3,008,424	145,985	334,645	842,848	1,319,339	29,728	113,415	222,464	39,653	329,459	55,895	8,103	1,869	434,979	
	10	424,175	49	876,794	4,266,537	1,461,867	5,728,404	3,482	71,356	1,243,998	258,714	4,150,854	w 673,337	690,197	1,831,552	650,915	63,995	233,283	7,575	w 36,681	699,420	156,997	4,091	570	897,759	131
	L 4	L 439,250	L 24	L 656,920	3,597,011	21,188	3,618,199	0	7,192	k 647,737	519,077	2,444,193	424,027	348,326	232,952	1,054,290	42,797	243,261	98,540	42,317	406,884	59,383	23,844	4,931	537,359	132
	3	187,500	6	374,605	1,650,969	40,075	1,691,044	0	11,405	261,056	13,936	1,404,647	.....	332,133	734,018	261,030	64,016	0	13,450	.....	a369,030	a 87,883	a 2,443	a 965	a460,321	133
	3	104,500	12	210,685	1,138,571	16,468	1,155,039	0	13,994	254,910	29,907	856,228	(f)	f 236,221	228,218	323,653	5,427	43,154	19,555	(f)	f 172,209	23,125	640	256	196,230	134
	0	0	12	203,534	983,096	50,323	1,033,419	0	15,824	142,309	118,313	756,973	19,815	126,340	99,586	427,821	6,506	37,636	39,269	6,194	62,638	10,390	607	91	79,920	135
	3	90,000	7	93,465	588,794	155,751	744,545	0	k 2,327	129,486	1,332	611,400	18,845	145,540	94,903	266,693	13,249	50,031	22,139	15,277	105,055	14,809	207	1,163	136,511	136
	1	15,000	12	100,080	581,405	18,879	600,284	0	3,920	85,978	351,655	158,731	w 14,185	54,942	28,106	59,391	1,566	0	541	w 3,165	25,260	6,598	105	80	35,208	137
	2	42,500	1	9,600	188,052	360,709	548,761	0	1,133	65,203	159,052	323,373	3,635	50,828	55,446	207,958	5,506	0	0	4,478	36,307	5,696	572	207	47,260	138
	0	0	2	83,000	525,993	0	525,993	0	1,238	32,273	492,482	0	0	0	0	0	0	0	0	0	0	0	0	0	0	139
	1	30,000	4	209,000	469,700	1	469,701	(t)	(t)	87,139	15,956	366,606	0	119,978	82,378	113,802	19,833	30,615	0	0	83,920	9,319	3,211	447	96,897	140
	2	34,000	3	114,000	417,408	0	417,408	0	1,343	65,073	9,701	341,291	.....	63,980	37,348	219,904	7,198	469	12,392	.....	32,626	3,865	1,003	297	37,791	141
	2	8,135	9	50,875	216,555	200,366	416,921	k 195	7,925	95,740	44,305	268,756	44,255	34,803	d 140,511	(d)	907	48,280	0	1,459	28,093	d 6,334	(d)	60	35,946	142
	1	10,000	9	21,817	158,175	125,126	283,301	0	4,470	59,019	6,003	213,809	w 13,634	74,401	66,120	52,025	3,272	1,662	2,695	w 15,666	49,940	13,819	151	192	79,768	143
	1	99,000	0	0	247,690	16,337	264,027	0	3,643	38,676	1,601	220,107	42,552	50,918	55,579	43,070	6,439	14,780	6,769	15,606	65,380	14,141	147	121	95,395	144
	0	0	2	45,800	240,845	9	240,854	0	0	240	240,614	0	0	0	0	0	0	0	0	0	0	0	0	0	0	145
	45	16,235	13	6,306	58,769	127,074	185,843	0	k 2,843	29,327	4,775	148,898	440	61,078	22,636	61,459	2,887	0	398	254	49,212	8,736	2,592	112	60,906	146
	1	1,000	2	34,000	177,957	2,120	180,077	0	15,364	15,169	77,671	71,873	(P)	(P)	(P)	(P)	(P)	(P)	P 71,873	(P)	(P)	(P)	(P)	P 18,092	18,092	147
	0	0	1	86,400	151,770	0	151,770	0	6,530	656	p 144,584	0	0	0	0	0	0	0	0	0	0	0	0	0	0	148
	1	27,000	1	125	136,258	4,687	140,945	0	1,378	6,524	151	132,892	112	4,896	2,997	124,216	273	0	398	80	4,591	458	134	3	5,266	149
	0	0	1	X 31,250	112,693	0	112,693	0	0	0	x 112,693	0	0	0	0	0	0	0	0	0	0	0	0	0	0	150
	80	1,528,295	170	3,208,256	15,908,248	2,600,980	18,509,228	3,677	171,885	3,260,513	2,602,522	12,470,631	1,254,837	2,394,581	3,712,350	3,866,227	243,871	703,171	295,594	141,177	2,190,565	421,553	39,747	27,587	2,820,629	
	1	20,000	45	1,140,000	g5,910,279	g2,763,004	g8,673,283	.....	.....	405,984	689,156	4,804,892	4,941	70,154	105,288	2,560,323	7,461	18,363	Q2,038,362	16,617	90,198	23,511	382	384	131,092	151
	0	0	18	701,372	4,700,149	1,223,739	5,923,888	0	23,856	146,142	1,062,253	2,092,042	(f)	f 146,609	175,927	1,623,420	16,520	129,566	0	(f)	a,f223,572	a 36,678	a 7,364	a 22	a267,636	152
	1	20,000	5	548,720	2,348,851	951,586	3,300,437	0	0	51,437	1,411,634	1,545,728	957	11,955	8,908	1,516,144	1,342	3,620	2,802	2,714	17,949	4,150	37	341	25,191	153
	1	6,750	17	534,608	3,005,914	2,885	3,008,799	0	0	15,283	832,703	1,630,334	.....	.....	.....	1,630,334	.....	.....	.....	.....	.....	.....	4	.....	4	154
	0	0	1	420,000	2,362,812	115,508	2,478,320	0	0	53,144	84,301	1,342,199	.....	223	19	1,341,957	.....	.....	.....	.....	13	1	5	.....	19	155
	0	0	1	200,000	1,479,644	0	1,479,644	0	0	106,896	8,414	1,119,006	1,800	5,317	3,958	1,107,363	568	0	0	667	5,627	1,187	26	5	7,512	156
	0	0	5	167,700	1,235,333	57	1,235,390	0	1,074	86,594	34,019	710,046	0	104,076	45,270	217,378	1,653	34,953	306,716	0	24,362	5,146	1,524	29	31,061	157
	1	X 12,000	3	X251,100	830,659	0	830,659	0	0	57,236	0	683,908	.....	30,165	22,244	630,036	1,463	0	0	.....	20,898	4,243	57	18	25,216	158
	0	0	9	94,375	475,132	274,772	749,904	0	8,760	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	159
	0	0	1	75,000	g 611,083	0	g 611,083	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	160
	1	11,000	2	115,820	590,672	0	590,672	0	(t)	87,573	579	502,520	0	201,019	27,915	100,244	14,866	0	U158,476	0	41,352	2,463	3,575	6	47,396	161
	1	X 17,500	5	X211,325	504,689	0	504,689	83,149	9,840	36,521	8,605	366,574	.....	95,891	77,135	181,498	12,050	0	0	.....	93,735	16,154	3,165	16	113,070	162
	0	0	1	74,900	349,027	0	349,027	0	0	14,845	0	334,182	.....	.....	2,790	.....	.....	.....	331,392	.....	.....	1	.....	2	3	163
	0	0	4	54,200	256,234	0	256,234	1,040	.....	10,342	20,872	223,980	58	246	212	223,423	41	0	0	116	419	137	18	4	694	164
	0	0	5	43,865	215,244	35,631	250,875	0	1,232	39,871	70,910	138,862	923	18,939	10,267	84,110	3,466	0	Q 21,157	1,596	22,466	4,542	557	118	29,279	165
	.....	Z 318	....	Z 75,850	244,128	272	244,400	0	0	11,883	45,061	187,456	(f)	(f)	f 1,192	186,195	69	0	0	(f)	(f)	f 3,511	11	16	3,538	166
	0	0	1	45,000	238,094	0	238,094	0	0	0	238,094	0	0	0	0	0	0	0	0	0	0	0	0	0	0	167
	1	X 4,000	2	X 12,200	95,858	109,167	205,025	0	.....	.....	464	204,561	(f)	f 80,946	(d)	d 86,066	616	12,136	24,797	(f)	f 24,367	(d)	d 4,753	251	29,371	168
	5	13,077	3	53,000	143,205	1,960	145,165	0	646	17,844	91,751	34,924	375	4,726	9,102	19,521	1,200	0	0	327	9,291	5,414	22	101	15,155	169
	12	104,645	128	4,819,035	g19,075,645	g2,715,577	g21,791,222	84,189	45,408	1,141,595	4,598,816	15,921,214	9,054	770,266	490,227	11,508,012	61,315	198,638	2,883,702	22,037	574,249	107,138	21,500	1,313	726,237	
	2	31,000	15	207,000	1,083,184	10,385	1,093,569	0	21,165	361,245	0	711,159	1,435	91,183	44,125	3,548	12,337	74,798	483,733	132	201,326	54,092	42	8,644	264,236	170
	0	0	0	0	0	G 1,148,804	G 1,148,804																			
	2	390,000	0	0	1,061,095	95	1,061,190																			
	1	220,000	0	0	657,226	0	657,226																			
	0	0	0	0	0	589,565	589,565																			
	0	0	0	0	0	454,048	454,048																			
	0	0	0	0	0	314,867	314,867																			
	0	0	0	0	0	243,466	243,466																			
	2	180,000	0	0	221,873	3,749	225,622																			
	1	43,000	0	0	91,973	79,407	171,380																			
	5	42,955	0	0	95,098	36,875	131,973																			
	0	0	0	0	0	124,985	124,985																			
	0	0	0	0	0	123,507	123,507																			
	1	74,000	L 2	L 16,000	70,016	B 45,488	115,504																			
	0	0	0	0	0	105,631	105,631																			
	12	949,955	2	16,000	2,197,281	3,270,487	5,467,768																			

SUMMARY OF GENERATOR RATING AND OUTPUT OF LARGE UTILITY SYSTEMS

Region	No. Cos. of System	Number of Generating Plants and Generator Rating — All Plants — No.	All Plants — Rating, Kw.	Fuel Plants — No.	Fuel Plants — Rating, Kw.	Hydro Plants — No.	Hydro Plants — Rating, Kw.	Energy Generated (Net) Thous. Kw.-Hr.	Rec'd by Purch. or Interchange Thous. Kw.-Hr.	Output Gen. and Purch. Thous. Kw.-Hr.
United States (g)	**150**	**1,796**	**34,382,006**	**916**	**24,184,617**	**880**	**10,197,389**	**116,724,505**	**14,845,051**	**131,569,556**
New England	17	176	2,483,765	46	1,719,477	130	764,288	7,539,818	1,526,111	9,065,929
Middle Atlantic	22	291	9,300,813	127	7,552,610	164	1,748,203	32,160,419	3,042,608	35,203,027
East North Central	28	312	8,295,857	148	7,716,065	164	579,792	28,486,759	2,033,440	30,520,199
West North Central	16	244	2,414,486	160	1,908,179	84	506,307	7,498,322	221,206	7,719,528
South Atlantic (g)	16	147	2,049,862	91	1,318,248	56	731,614	6,664,154	2,199,109	8,863,263
East South Central	8	111	1,775,263	83	639,194	28	1,136,069	5,978,167	2,003,969	7,982,136
West South Central	16	169	1,669,590	158	1,587,522	11	82,068	6,304,827	696,603	7,001,430
Mountain	7	96	1,655,819	23	215,027	73	1,440,792	6,183,791	521,025	6,704,816
Pacific	20	250	4,736,551	80	1,528,295	170	3,208,256	15,908,248	2,600,980	18,509,228
Canada (g)	19	140	4,923,680	12	104,645	128	4,819,035	19,075,645	2,715,577	21,791,222
Mexico	1	17	238,000	2	31,000	15	207,000	1,083,184	10,385	1,093,569
Railways and Railroads	14	14	965,955	12	949,955	2	16,000	2,197,281	3,270,487	5,467,768

(143) Distinct rural rates only.

x Line 86 — Col. 12, incl. 14,070 frequency changer oper. Col. 13, incl. "firm peak" service to Pot. El. Pwr. (150) San Joaquin Lt. & Pwr. at transformers.

y Commercial.

z Industrial or power.

A Estimated figures.

B Output of leased plants.

D Includes affiliated or subsidiary cos. Line 26 — Incl. affiliates also Litchfield E. L. & P., Granville El. (40) Incl. Comm. Ed. P. S. of No. Ill., Western United G. & E., Ill. Northern Util., Chicago Dist. Elec. Gen. Corp. (46) Comprising Wis. E. P., Wis. G. & E., Wis. Mich. P. (55) Sub. Menominee & Marinette L. & T. (75) Incl. Iowa Pwr. & Lt. (104) Includes Lexington Util. and Old Dominion Pwr.

G Purch. LIRR 220,962
PRR 927,842

H No-charge energy, entered in this col. for convenience.

L Line 132 — Incl. one leased int. comb., 24,250; two leased hydro, 166, 800. (183) Leased.

O Gross.

P Cols. 15–21 combined; also Cols. 22–26 combined.

Q Electric boilers.

T — Line 72 — Also 250 kw.int. comb. standby. (95) Actual cap. limited by boilers to 12,500. (111) Name plate; capable capacity, 164,696.

U Off-peak.

X Kva.

Y Mainland system only.

Z Hp.